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ON another page we conclude Mr. OTTOKAR HOFMANN'S admirable monograph on "Lixiviation of Zinciferous Silver Ores." This is unquestionably one of the most valuable contributions ever made to this important department of metallurgy, and should be carefully studied by all who are interested in the treatment of this class of ores. Mr. HOFMANN'S numerous and careful tests, as so clearly recorded by him, seem fully to confirm the claims already made for trough lixiviation as being a distinct advance, and a very important one in hydro-metallurgy.

## PRODUCTION OF COAL IN THE UNITED STATES IN 1888.

The Geological Survey and its agents are deserving great praise for the promptness with which they are bringing out the reports of mineral production. Already the preliminary estimates of copper and zinc production have been published, and now the statistics of coal production, a much more difficult and tedious work, are furnished us. From these figures, given in detail on another page, we learn that the total production, including colliery consumption, of coal in the United States in 1888 amounted to 145,363,744 short tons (129,789,057 tons of 2240 pounds) about 15,000,000 net tons more than in 1887.

This enormous increase in output promises to place our country in a short time at the head of the coal producers, though it is scarcely possible that the recent rate of increase can be maintained this year; in fact it is probable that 1889 will see a very small, if any, increase in output over 1888.

For the convenience of our readers we have carried out the values given in the efficient report to the ton value in each state.

These figures show generally a higher range of values at the mines in 1888 than in 1887. But in some cases we are forced to believe there must be some error in the figures, thus the average value of coal in Missouri in 1888 is given as \$3.21 per ton, while in 1887 it was \$1.34 per ton, a more probable figure. In Alabama and Tennessee the average value has declined to \$1.15 and \$1.10 per ton respectively, but the average value in other states has generally increased; that of the entire output is still only \$1.45 per net ton, or say \$1.60 per ton of 2240 pounds.

## THE BRITISH SHIPPING TRADE.

Mr. EVAN R. JONES, United States Consul at Cardiff, who has given much attention to the statistics of the shipping industry of the world, has published, as one of the series of consular reports, his review for 1888. He takes a favorable view of the general outlook for 1889, based partly on the experience of the last ten years and partly upon orders for ships known to have been placed. He dwells upon the continued substitution of steel for iron, and estimates the increased carrying power of steel vessels over those of iron at 12 per cent. The tendency is to increase in size of both sailing and steam ships. Steam freight vessels are

becoming proportionately more numerous. Mr. JONES thinks, however, that the rule of estimating steam tonnage as equal to three times that of sailing ships of the same register is rating the steamers too high.

Between 1878 and 1887 the total merchant tonnage of the United States fell off 614,000 tons, that of Great Britain gaining during the same period 904,000 tons. The tonnage launched in Great Britain in 1888 was 906,131 tons, the largest output since 1883. Mr. JONES' figures in detail, with his comments, give a striking picture of the sudden fluctuations which have occurred in the British ship building and carrying trades. There are prosperous years, when ships have been known to return as much as 40 per cent profit; and lean years when very many are laid up in idleness. The trouble seems to be that after a good year or two capital rushes into the shipping business with the result of overstocking it. Then follows a dull period during which the loss and decay of vessels, in connection with the natural growth of the world's carrying trade, restores the equilibrium for a while, and so the process is repeated intermittently.

## LONDON MINE GAMBLING.

London has periodical investment or gambling crazes. At one time it is railway "securities," so called, at another the bonds of some bankrupt State, at still another some South Sea bubble in the shape of Indian or African gold mines. At present the fever is African and Burmese. The Transvaal gold mines are undoubtedly a vast improvement on the Indian mines, over which our credulous cousins went into "fits" a few years ago. The Transvaal offers several distinct advantages over many other districts as a field for investment in gold mines. In the first place it actually has gold in its mines, and apparently a good deal of it. A number of its mines will probably pay dividends if worked skillfully and economically, and, if the mines should not pay largely, at least the vast numbers of English and Americans that they are drawing there will be certain to bring to an end the Boer government of that country, and we believe it is generally conceded that this would be a vast benefit to South Africa.

The latest London craze was finely exhibited at the recent allotment of shares in the Burmese ruby mines, concerning which our well-informed London correspondent wrote us February 15th: "The mines may be immensely valuable, or perhaps not; no one can tell as to this until a year's work has been done upon them." All London rushed to get the prospectus, and the crowd began to collect in front of the ROTHSCHILD'S offices long before they were open in the morning. The £1 shares went immediately to £4, and the total amount of stock offered was applied for many times over.

These shares are "a pure gamble," even more than is usual in mining, though they have this advantage over most of the London mining stocks, that there is a possibility that they will pay, and pay largely, while the average London mining stock is absolutely certain never to pay anything.

## A GREAT COPPER FURNACE RECORD.

The immense progress made in copper smelting in this country in late years, as recorded in these pages, has attracted the attention and admiration of metallurgists throughout the world, and the record of the manner in which these results are attained, as given in Dr. PETERS' "Modern American Methods of Copper Smelting," have created for his excellent work a demand from every civilized country. It is a great pleasure to us to be able to put on record constant improvements in this art, and especially where the practice develops new features.

The remarkable work done on roasted copper pyrites by the Herreshoff water jacketed furnace has been frequently referred to in these pages.

The Sudbury mines in Ontario produce an ore remarkably high in nickel, and the Canadian Copper Company has for some time past been smelting these ores in a Herreshoff furnace, the works being managed by Dr. E. D. PETERS himself. We have had occasional intimations that excellent work was being done there, and the following letter, recently received from Dr. PETERS, gives fuller and more precise information as to what this work has amounted to:

"By permission of the Canadian Copper Company, I should like to put on record some smelting results which I think are unusual for a water jacket furnace, running solely on heap roasted pyrites ore and raw fines, and producing a matte of about 40 per cent in combined copper and nickel, but of which so large a proportion is nickel as to raise the fusion point of the matte several hundred degrees above the ordinary smelting temperature of copper mattes of the same grade, and thus seriously affect the consumption of fuel. The record for one twenty-four hours was 154 tons of ore smelted, and the daily average for the week was about 135 tons of ore. Ratio of ore to coke, almost 8 to 1. The furnace is Geo. H. Nichols & Co.'s patent, and is about 39 x 78 in. high at the tuyeres. Not a brick is used below the charging door, except to protect the bottom at starting. Delays or repairs for the week, nil; pressure of blast, about 10 ounces; foul slag for the week, about 500 pounds.

"It must be understood that no especial effort was made to crowd the furnace beyond its ordinary work, and that both roasted ore and coke were full of snow and ice, and that all the work was done under the disadvantages attending an Arctic winter."

The company is about to erect a second furnace, practically a duplicate of that whose work is above described.

## THE SAMOAN SCARE.

Last week's rumors about the Samoan difficulty, which, fortunately, have turned out to be groundless, will at least have had the good effect of awakening public attention to the unprepared state in which this country would be found in the event of war. All the warnings of the technical press, the army and navy official reports, the discussions in Congress, could not so arouse attention as the sudden prospect of being called upon to face a foreign power in the highest state of warlike preparation. It is to be hoped that this effect will not evaporate without some practical results. The episode shows how unexpectedly we might be precipitated into war; and this question of suddenness is a vital one. After all, whether the country is to be properly supplied with means for defense, depends much more upon a general demand for such defensive preparation than upon any effort of the army and navy officials.

It is all very well to point to the list of recent additions to the navy and to the new vessels (eight, we believe) to be designed by the beginning of the next fiscal year, and to say by how much their construction could be hastened; to refer to the guns ordered, building or to be built, and to figure out that in the course of the next eighteen months or so our fighting strength will be about doubled. That would be small consolation in an unlooked-for emergency. In modern military operations days count as much as months would have done in the past, while the time required for construction is extended in inverse ratio.

There is no question as to the latent force of the United States. This is recognized by foreign powers quite as much as it is mistakenly relied on by the majority of our own people. But it must be acknowledged that we would have an awkward time of it before this reserve strength could be brought into action. In the meantime we would have to rely rather upon European complications, jealousies and alliances than upon ourselves. Ships and guns cannot be extemporized after the fashion of old times.

It is to be regretted the alarm should have come just when it does, in the midst of important changes in the executive and diplomatic services, and after the plans and appropriations for vessels, guns, fortifications, and experiments have been settled upon for a year ahead. A little wholesome stirring up early in the last session of Congress might have been a salutary thing. Congress can never be accused of being extravagant in this line.

## THE ELECTRIC LIGHT CONVENTION AND THE USE OF HIGH TENSION CURRENTS.

The Chicago Convention of the National Electric Light Association debated the underground question with some vehemence, but not with very definite result. Mr. BARRETT, the Chicago City electrician, was singularly unable to give precise information of a scientific character, although he fluently repeated the assurances of complete success in Chicago with which he has heretofore satisfied the newspapers, and they filled the ear of fame. We are not disposed to perfect belief in Mr. BARRETT'S accuracy by such a test as is offered (according to the published report in one of the electrical journals) in his statement that President PLYMPTON of the Brooklyn Subway Board, after visiting Chicago, returned and misrepresented the state of affairs there, and that when Prof. PLYMPTON came again, the City Electrician "took him in charge, and said to him, Professor, don't make that report when you go home again, or I will take a derrick and put you into a manhole"—all of which, we are authorized to say, is pure invention, from beginning to end. It is quite true that President PLYMPTON has visited Chicago, seen whatever Mr. BARRETT had to show, and heard what he had to say; and it is not improbable that President PLYMPTON thinks a man who can consider the present condition of Chicago, where all parties go as they please, and the city electrician smiles (between explosions) on the result, a "solution" of the "problem," is ignorant either of the nature of a problem or the nature of a solution, or both. But nothing like the scene which Mr. BARRETT is reported to have described ever took place. He has never complained, or had reason to complain, of his treatment at the hands of the President of the Brooklyn Board.

The most confident man in the whole debate was Mr. JOHNSTONE, the patentee of the Johnstone system. He too attacked Professor PLYMPTON, for having gone all over the world, and not visited the Johnstone success in Philadelphia. Said this disinterested expert:

"I want to tell you a little story that I heard about this astute, wise and honest Commissioner of Brooklyn, Professor Plympton, who, as a very talented gentleman, was sent all over the world. They killed a man in New York on one of those high-tension currents . . . and the family very properly sued the company, and the coroner subpoenaed everybody that had any knowledge on the subject. Professor Plympton was brought from Brooklyn, and he testified about this wonderful trip when he could not find anything at all underground in any part of the world. The District Attorney said: 'Did you ever go to Philadelphia?' Mr. Plympton did not know that such a town existed; at least he had not been there."

It is hardly worth while to state the whole of the incident out of which this pretty episode in the coroner's jury practice of the District Attorney has been manufactured. Suffice it to say, that Professor PLYMPTON, when asked by a jurymen whether he did not know that a system of underground arc light conductors had been successfully operated for

three years in Philadelphia, replied with perfect sincerity and appropriateness that he did not. He might have added that nobody did; because there was no such system. Mr. JOHNSTONE may feel perfectly assured that the Brooklyn Board is well informed as to the state of affairs in Philadelphia, that its president and its electrician have personally examined the ground, and its agents have furnished reports sufficiently frequent and detailed to enable it to know what has been "operated," and with what results. It is probable that this board knows more about Mr. JOHNSTONE'S "success," in particular, than has ever been made public by it or by him.

Unfortunately for his success in this debate, Mr. JOHNSTONE encountered an opponent, Mr. DECAMP, of Philadelphia, who happened to be the manager of the Johnstone system, for the company to which that gentleman's original organization sold out. After the speech of Mr. DECAMP, Mr. JOHNSTONE was not heard from. "The subsequent proceedings interested him no more."

The best thing brought out in the debate was an excellent letter from the eminent practical electrician, Prof. ELIHU THOMPSON, the substance of which was, that the systematic placing of telephone and telegraph wires underground in cities was practicable enough; that wires above ground ought to be subject to inspection and regulation, and that high-tension currents presented difficulties which rendered it wise to move cautiously and gradually in any measures regarding them—and especially not to attempt, by wholesale, imperative and immediate decree, to forestall the careful consideration of the conditions of each case.

The Convention did a good thing, also, when at the close of the debate it continued its special committee, and added to it Messrs. SPERRY, SUNNY and BARRETT, of Chicago, three gentlemen who, believers in the completeness of the systems and apparatus they are using, will now have a chance to answer more completely than they have hitherto done, the questions and objections of less fortunate or less sanguine experimenters.

The most hopeful sign of the present situation, however, is the effect of the late "Refrigerator" decision of the Supreme Court in giving to the Edison party something more to fight for, and hence something more to trade with, in their opposition to the younger and more rapidly advancing party of the "alternating currents." There ought to be a union of these two great interests, permitting the best intellects on both sides to solve the questions arising in practice without hindrance from patent prohibitions. So long as vast moneyed interests are involved in the denunciation of high-tension as positively inadmissible by reason of its danger, the simple truth will not be made clear to an ignorant public that nothing ever was or will be rejected by civilization because it was dangerous, if it was only cheaper and more effective than that which it replaced. Steam, illuminating-gas, water-gas, natural gas, gunpowder, dynamite,—all of them have been first feared, then tried, studied, and finally universally employed, under such precautions as science and experience indicated. The transmission of electric energy will have the same history. The high tension currents have come to stay. Higher and higher potentials will probably be used, because they are cheaper in transmission; and, but for the pernicious conflict of patentees, greater progress would have been made ere now in the direction of the public safety and convenience.

## WILL THE WAR SHIPS OF THE FUTURE BE ARMORED?

After the adoption of fire arms as the principal weapons of warfare, the first tendency of the efforts to provide an adequate defense were in the direction of an increase in the thickness of armor. For a time the attack and the defense about kept pace with each other. The arms were very inefficient, the powder was bad, and it was possible to provide the heavy fighting men with armor which, in part at least, protected them. But as the range and power of the guns increased, so had the armor to be thickened; and besides the simple question of its dead weight there was the great disadvantage of clumsiness.

The gallant knight, who in the ante-gunpowder days could hardly mount his horse without the aid of his querry, would have found matters decidedly worse at a later date. If unhorsed it would have required the help of his attendant squires to set him up for a fresh start. Then the importance of the infantry began to be recognized—that is, the arm of the service which inflicts the most damage but is itself most exposed, was found to be more effective than the unwieldy heavy cavalry. So, gradually armor was discarded piece by piece, until now we have little more left than the helmet and cuirass of the dragoon, which are still sometimes worn, as much, perhaps, because of traditional usage and for ornament as for any practical utility.

Now the great ironclads of to-day correspond to the knights of old; they are becoming more and more unwieldy; they are expensive to build, equip and maintain; the great weight of armor deducts so much from their offensive power, and coal and machinery space; and it is extremely doubtful whether they can face modern guns of comparatively low power with success. The whole subject will remain undecided until

an important naval war settles it by actual experiment. Since the Huascar fight, the bombardment of Alexandria, and the Glatton trials, there has been little added to our knowledge of the relative progress of guns and armor. Tests of armor-plate may show the resistance of a given weight and quality of metal to actual penetration or breaking up by guns of different powers; but these targets do not really represent the section of an armored vessel's side. A ship cannot be buttressed with masonry and timber bulkheads as are the targets usually set up. It is quite possible that a square blow from a projectile utterly incapable of piercing the armor might bodily crush in the frame-work, or by merely detaching plates produce fatal results. A ship's side can not have the resisting power of a turret or barbette parapet without increasing the weight of framing, armor and backing to an enormous extent. It is evident that small vessels cannot, by means of armor, be constructed so as to resist fire and at the same time have any great offensive force, speed, or coal endurance. Thus in the later progress of European navies, in order to secure a fair average of each of the factors which go to make up a war ship, the tendency has necessarily been to an immense increase in size and cost. Now the question arises: Is a \$5,000,000 ship more effective than two of \$2,500,000, or perhaps even five of \$1,000,000 each, or to use a homely saying, is it better to put so many eggs in one basket?

We think that a type of vessel for coast defense can be built with advantage on our own low free board Monitor system, in which the defense is to a great extent supplanted by immersion, thus reducing the portion exposed to the last degree; having relatively high gun power, but not necessarily of much speed or coal capacity. The great need just now is for guns, not armor. If people will insist on going to war, they should bear in mind that somebody is likely to be hurt, and that perhaps after all the best protection is the ability to damage the other side more than they can inflict harm, as is the rule in land warfare. But the attempt to increase armor to the point reached by the guns seems hopeless. There is a limit to the weight of armor which can be carried, but it would be hard to say where the gun-power is to stop. Not so long ago an 80-ton arm was a monster: then the 100 and 110-ton guns seemed to be about the largest which could be safely built and used. But these may be succeeded, as is threatened, by guns of 150 and even 200 tons, against which no existing armored ship would have much chance.

The "protected" cruisers are becoming more popular each year, and for general service are a marked advance on former types. Our new ships are fairly satisfactory, though it is a pity that higher speed was not aimed at, and a less miscellaneous armament not selected. They carry too great an assortment of calibers and models, a result of the tentative policy of our designers. Can such vessels meet armor-clads of equal offensive strength on anything like equal terms? They should, for a given gun power, have greater speed and manœuvring ability, to offset the weight of armor dispensed with.

If the great ironclads represent the knights in armor, the "protected" cruisers are like light cavalry, and it is obvious that the latter have supplanted the former. How long it will be before the change is completely effected, or whether this change will in fact ever be made, it would be unsafe to say positively; but the indications point in one direction. The race between the European governments in building big ships cannot be kept up indefinitely, if for no other reason than the expense involved. But it would certainly be bad policy for our constructors to switch off on any wild innovation in advance of that experimental test which may be looked for at any time. There are imperative and immediate needs to be met; and afterwards we can try a little experimenting.

It is barely possible that if armor be discarded or greatly reduced the guns, too, will change in the direction of moderate calibers and of higher relative power, just as is being done with infantry small arms, for the sake of increasing the range and securing a flatter trajectory with extended danger zone. Then, if the building of the largest guns were to cease, it might be possible for armor to take a fresh departure, so that instead of a final settlement of the much-vexed problem of guns vs. armor, there would be merely a renewal of the see-saw of the last thirty odd years.

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 Future of Phosphates in the United States and Canada.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: In the March 9th issue of your esteemed JOURNAL, the correspondent, "F. F.," states that the great drawback to the manufacture of cheap acid phosphate is the cost of good pyrites. He evidently has the idea pretty well fixed in his mind that American pyrites are neither abundant enough nor rich enough to pay for working; that the absence of copper in any but the Canadian ore is the chief drawback. There is more or less truth in this statement, but at the same time I have been working a pyrites-copper mine for the part four years, for copper only, and throwing away the sulphur, simply because there was no demand for it at the point where

our smelters were located, and it would not pay to ship the ore to acid works and pay return freights. This, too, in the face of the fact that our works are located at one of the best shipping points on the Atlantic coast, and within easy reach of the Canadian phosphate deposits. I refer to the Milan mine, located in New Hampshire, and within 100 miles of Portland, Me., where our smelters are now established. Freights on Canadian phosphate rock to Portland can be had at a very low rate. The pyrites are not excelled for producing acid, and have been largely used for that purpose. Here, then, all the conditions asked for by "F. F." are to be had; pyrites cheaper than they can be obtained in England, cheap freights on Canadian rock, and as good a distributing point as can be found. I would also state that South Carolina rock can be and is shipped here about as cheaply as to New York. Either "F. F." is way off in his reasoning or acid phosphates can be manufactured here in this country cheaper than in Europe.

PORTLAND, March 12, 1889.

F. L. BARTLETT.

The Philadelphia Smelting and Refining Company.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: In your publication of February 23d, your Trinidad correspondent makes an erroneous statement concerning the condition of the works of the Philadelphia Smelting and Refining Company, which, we trust, you will contradict in your next issue. It is not a fact, as stated, that our furnaces are not successful. We have at present our entire six furnaces in successful operation, some of which are crucible, others non-crucible. Their records are so similar that it would be impossible to say which is the better.

We positively deny that our ores are of too refractory a nature to produce good results. On the contrary, we are running full blast, and are using the very ores referred to as being too refractory.

The success of our institution has been such that we have increased our capital stock from \$500,000 to \$1,250,000 full paid in, and we are now preparing to double our capacity throughout.

Herewith attached please find the records taken from our books from February 23d to the 26th inclusive. We take pleasure in sending you the same from a metallurgical point of view. You will observe that the non-crucible furnaces have smelted the largest number of tons during these four days.

The economical metallurgical feature of these furnaces is that they have no crucibles, thereby avoiding the necessity of carrying \$5000 worth of base bullion in the bottom of the same.

The separation of the lead, matte and slag occurs outside the furnace in a large pot having a partition, the lead sinking to the bottom and passing beneath. The partition prevents the slag from going into the far end of the separator thereby enabling us to dip out molten lead in the same condition that we would do in the crucible furnaces.

Crucible furnaces.		Non-crucible furnaces.	
Charges 24 hours.		Day shift. Night shift.	
Day shift.	Night shift.	February 24th.	
No. 1.....56	66	No. 5.....68	74
No. 2.....74	74	No. 6.....60	70
February 23d.			
No. 1.....65	62	No. 5.....72	70
No. 2.....68	74	No. 6.....60	68
February 25th.			
No. 1.....56	62	No. 5.....68	70
No. 2.....72	76	No. 6.....64	66
February 26th.			
No. 1.....56	76	No. 5.....70	70
No. 2.....64	70	No. 6.....64	80

Trusting that these statements, which by the slightest effort in investigate will prove themselves, will find a proper place in your columns, we are,  
Yours very respectfully, BENJ. GUGGENHEIM, Treasurer.  
PUEBLO, Colo., March 4th, 1889.

PRODUCTION OF QUICKSILVER AT THE ALMADEN MINE (SPAIN) IN 1888

January, 1888.....	8246 flasks.
February, ".....	7972 "
March, ".....	7956 "
April, ".....	6856 "
May, ".....	1950 "
October, ".....	3318 "
November, ".....	7609 "
December, ".....	7965 "
Total.....	51,872 flasks.

We are indebted to the courtesy of Mr. J. B. Randol, of San Francisco, for this information concerning the production of the Spanish Almaden mine in 1888. It will be observed that the total production for eight months, the usual working period of the year, was 51,872 flasks while all our Californian mines for twelve months in 1888 made only 33,250 flasks, or 18,622 flasks less, than the product of the glorious mine of Almaden, rightly entitled to be called not only "The Jewel of the Crown," but also "The Jewel of all Mines."

THE NEXT CENSUS.

The Washington correspondent of the New York Graphic writes: The salary of the superintendent of the next census will be \$6000 a year, \$1000 more than was received by the previous superintendent. There is to be a thorough organization this time—ten chiefs of division, a disbursing clerk and two stenographers at \$2000 a year each, and there are to be 175 supervisors instead of 150, owing to the increase of population. Enumerators are to be paid the same as in 1880, excepting for special work. In 1880 the compensation was 10c. for each farm and 15c. for each establishment of productive industry. The pay has been increased to 15c. and 20c. respectively. In 1880 there were 4,008,907 farms. Mr. Wright, Commissioner of Labor Statistics, thinks that at the outside there will not be more than 5,000,000 farms in 1890, as consolidation rather than disintegration is the rule. This would add \$250,000 to the cost of enumerating the farms. There were 253,852 manufacturing establishments in 1890, and the increase now will not add

greatly to the cost of enumerating them. One provision in the bill is new to the Federal census, and will please the Grand Army men. It provides for securing facts relative to survivors of the late war, with an enumeration of all veterans living. This will give name, age, residence, length of service and command of every surviving veteran. Another important provision relates to the recorded indebtedness of private corporations and individuals. This will cost \$250,000 to collate. It is not expected to get absolutely reliable statistics on this subject, but all recorded indebtedness and enough other information which will approximately show the indebtedness of the whole people.

Still another important provision will secure reliable statistic of the negro race, giving number of mulattoes, quadroons and octroons. Whether the race is becoming more purely negro will be settled by statistics, of which this census will give the starting point. The ordinary statistics will show whether or not the negroes are concentrating in certain localities, as claimed by some persons, who say that the Gulf States will be largely given up to them in time.

A most important return will be made concerning the defective classes, who have increased 400 per cent in thirty years, while the general population has simply doubled. These statistics were partly in the last census.

Another defect of previous censuses is to be remedied in giving a record of animals not on farms. Heretofore horses in cities and villages, etc., have not been counted.

#### THE SOUTHERN GOLD-FIELD.

By F. C. Hand, M. E.

For many years, in fact ever since the rush to California in '49, this section of the country has been practically dead so far as gold mining is concerned.

The news of the rich strikes at Sutter's Creek and Feather River were followed by others, and, imbued with that spirit of unrest that forms so large a part of the composition of the prospector and miner, the whole mining population of Virginia, North Carolina, Georgia and Alabama were soon on the way to the new Eldorado—many never to return.

In the excitement of the first few years this interesting field appears to have been almost forgotten, and then came the war, causing a complete cessation of work in the few localities that had not been entirely depopulated by the California exodus.

After the war, for several years, under the new and changed condition of things, it was very difficult, if not impossible, to prosecute work in many of the mines. Labor, titles, and the unsettled state of affairs during, and immediately after, reconstruction prevented the influx of capital, and but little was done until it seemed as if gold mining in these once productive fields was to become a lost art.

Some spasmodic attempts were made, it is true, from time to time, but from various reasons many of them were failures. Lack of sufficient means to push the work to a successful conclusion in some cases, and ignorance, inexperience, and gross mismanagement in the others. Nearly all of the gold-bearing lodes in the South become highly sulphuretic as depth is reached, especially below water, and to an ignorance of this peculiarity many failures are chargeable.

The writer knows of several instances where expensive mills have been erected on the evident supposition that the free milling ore which was on the surface would continue in depth, but lo! at a depth of 40 or 50 feet, or as soon as water was reached, sulphurets began to appear, and subsequent "clean-ups" gave less and less, until, perhaps, nothing could be saved by simple amalgamation.

An entire change of plant became necessary or the work must be abandoned, and it is needless to add that the latter plan prevailed.

It has been said by a high authority, and repeated by lesser lights from time to time, that mismanagement, incompetence and a complete disregard of the simplest business principles were responsible for more failures in mining than all other causes combined, and to this I can add that the man who first made that exceedingly trite remark must have had this southern section especially in his mind.

All, however, have not been failures, as in North Carolina, Georgia, and Alabama, are to be found a number of producers that have gone steadily on in the face of all discouragements, and have well proven that, with careful, economical and efficient management, there is nothing in the whole South that promises such returns as these same old and so-called, worn out gold-fields.

Within the past year a new impetus has been given by the organization of several strong companies in Georgia and Alabama, and the attention of capital is evidently being drawn towards an exceedingly inviting field for investment.

In the Arbacoochee district in Alabama some considerable activity is being manifested. The Anna Howe Company, organized in Birmingham, have recently built a fine mill, which is now running regularly.

They have some excellent ore in their shaft, and are now making preparations to sink deeper. The prospect seems to be very favorable. The western extension of the Anna Howe veins has recently been purchased by Birmingham and New Orleans parties, who are making extensive preparations to develop it, putting up a mill, etc. This ore is very friable and easily milled and assays well.

About a mile further west is the hydraulic plant of the Amie Mining Company. They are well equipped with large boilers, pumping engines, sluice-boxes, etc., and are now running regularly.

They are working on a large and rich deposit of gravel, which shows up so well that the stockholders, a party of Connecticut gentlemen, are well pleased with the outlook. This is the first plant of this kind in this immediate vicinity, and indicates the energy and confidence of the projectors.

About a half mile further west is the Denson, still on the same lead. Considerable work has been done here in the past, both by washing and vein mining. A large deposit of gravel has been well prospected and several veins have been cut at different depths.

Messrs. Armstrong & Leake, who control it, are now preparing to recommence on a larger scale than has yet been attempted.

I also understand that the adjoining property, the Dothard, has been leased for a term of years to parties who will at once erect suitable machinery.

The Moss Back, about nine miles southeast from Arbacoochee, has several thousand tons of good ore on the dump waiting the erection of their mill, now nearly completed. They will soon be running.

The Merrill mine at Pinetucky, about five miles from the Mossback and about eight or nine miles from Arbacoochee, has been steadily raising ore for several months. They have made one or two shipments that, I believe, yielded handsome returns, and will no doubt soon erect a mill on their property.

The Carter White property, adjoining the Merrill, is, I understand, soon to be developed.

The low price of labor and fuel, \$1 per day for the former and 75 cents per cord for wood, render the development of these properties practicable at low cost, and will also be a very large factor in enabling them to be operated with a very low expense account.

There can be no doubt that this will allow a profit for working ores of lower grade than in almost any other part of the world.

#### THE CONSTRUCTION OF CUFOLAS FOR MELTING PIG IRON.\*

By M. A. Gouvy Jr.† Translated by W. F. Durfee, Engineer.

(Continued from page 234.)

##### VII.

##### CUPOLAS FIRED WITH GAS.

In all the cupolas before described the fuel is in direct contact with the metal being melted, and it is always necessary to avoid the use of a coke containing impurities, especially when the iron is intended for the manufacture of steel.

In searching therefore for a means of separating the fuel from the metal, we find no agent superior to gas, which is the final condition of all fuel whatsoever.

*The Dufrené Cupola.*—The cupola of H. Dufrené (Paris, 1881) was furnished with a gas-producer, situated in front of the apparatus (Figs. 33 and 34); the pig-iron and scrap were placed above the crucible upon a gridiron made of a good quality of refractory material, and the gas (previously mixed with air, heated by circulating around the walls of the gas-producer), traverses the gridiron and the iron piled upon it.

*The Besson Cupola.*—M. F. Besson, of Lyons, patented, in 1881, a gas cupola for rapid melting, furnished with a kind of blow-pipe (Fig. 35), which developed a very great heat in the apparatus; and there was besides above the crucible a special tuyere intended for the refining of the iron.

*The Bramhall System.*—In 184, M. C. Bramhall, of Sheffield, proposed a form of gas cupola, having a regenerator with four chambers, of the kind only used in the Siemens furnace, which were traversed right and left by the gas from the throat of the cupola; the system supposed also that this gas is at a comparatively high temperature, which would evidently be the result of bad management of the cupola. In all these cupolas it is necessary to watch carefully and maintain a reducing flame when we wish to obtain gray iron, but when we melt iron for puddling, it is easy to refine it by means of an oxidizing flame, but we are subject in this case to considerable loss.

*The Krigar Cupola, with two Shafts.*—A special system, patented by M. Krigar, of Hanover, already hereinbefore mentioned, may be also regarded as working with gas, with this very important difference, that the melted iron comes in contact with the ashes of the coke at the lower part of the apparatus, before it enters the crucible in its front.

This cupola is composed of two distinct shafts (Fig. 36); the one closed at its top is intended to receive the fuel and serve as the gas producer of the apparatus; the other receives simply the pig-iron, and materials mixed with it, such as scrap and flux.

The blast, under pressure, enters the gas-producer shaft above the front crucible, and after traversing the lower part of the fuel rises through the second shaft containing the iron.

We have given a very imperfect account of the advantages which are offered by this arrangement.

*The Riley System.*—The most interesting and most practical application of gas for melting in a cupola, is that made by Mr. Riley, of the Blochairn Works, at Glasgow,† for the manufacture of open-hearth steel; under this system the duration of the operation in the reverberatory furnace is reduced, by introducing the iron in a liquid state.

Mr. Riley arranges in convenient relation to the open-hearth furnace, a cupola fired by gas generated in a gas-producer furnished with a blast; in this cupola is charged the pig-iron, and then the steel scrap, without any solid fuel (Fig. 37).

The production of an open-hearth furnace is thus augmented in the vicinity of ten per cent; the principal advantage of this arrangement consisting in the fact that the oxidation of the carbon and silicon takes place in the cupola, and the operation in the open-hearth is, therefore, very much more rapid.

Mr. Siemens‡ mentions some experiments of similar kind tried at Landore, by Mr. Hackney; these experiments, it appears, were not successful, because they charged coke also in the cupola, the result being that the decarburization could not take place there instead of in the reverberatory furnace, in which the action of the oxidizing flame upon the bath of metal covered with slag is too slow.

With the apparatus at Blochairn, the melted iron is run into the reverberatory furnace two hours after turning on the gas; at first the charge of the cupola was pig-iron alone, then ten per cent of steel scrap was added, and the addition was continued until it

\* From the Journal of the Franklin Institute.

† Etude sur les cubilots pour la fusion de la fonte. Par M. A. Gouvy Fils, published in "Mémoires et compte rendu des travaux de la Société des Ingénieurs Civils," Paris, 1887, pp. 723-766.

‡ Autumn meeting British Iron and Steel Institute, 1885.

§ Autumn Meeting British Iron and Steel Institute, 1885.

amounted to ten tons for each ton of pig-iron; but in this case the lining of the furnace did not resist corrosion well.\*

The consumption of fuel in the gas-producer appears to have been reduced to 7.2 per cent of the pig-iron charged in the cupola; and the product per hour was two tons.

We must note that as early as 1844 Joshua Marshal Heath had taken a patent for a reverberatory furnace combined with an ordinary cupola for the manufacture of iron and steel, by the addition of manganese †—the apparatus was furnished with a carbonic oxide blow-pipe and tuyeres;—but Heath charged coke in the cupola; which resulted in the same inconvenience as in the experiment of Mr. Hackney.

(TO BE CONTINUED.)

LIXIVIATION OF ARGENTIFEROUS ZINOBLENDE AND GALENA ORE.

Written for the Engineering and Mining Journal by Ottokar Hofmann, M.E.

(Concluded from page 237.)

ERRATA.—In issue of 23d February, page 189, under the heading "Roasting Yedras Ore at a High Heat," "January 13th to February 12th,

We find that the two lots of precipitate differ considerably with regard to lead, copper, cadmium, zinc and sulphur. Such variations are principally caused by the character of the ore of which the precipitate is the resulting product, and to a great extent also by variations in roasting. The quantity of sulphur depends on the length of time the precipitate is subjected to roasting in the small reverberatory furnace. To avoid loss by volatilization the precipitate was left in the furnace only until the blue sulphur flame ceased, which accounts for the high percentage in sulphur. The per cent of lime, 3.88 and 3.62, is in both lots nearly the same, and shows that the value of the precipitate is not much depreciated by using calcium sulphide as precipitant, at all events not enough so as to make its use objectionable.

The dried precipitate contains 47.96 per cent sulphur. Experiments to regain the surplus sulphur by boiling the fresh precipitate with caustic soda, gave very satisfactory results. They showed that 60 per cent of the sulphur originally contained in the precipitate can, by this simple operation, be regained and brought into a state in which it can be directly used again as precipitant. Mr. Sustersic proposes to leach wood ashes, convert the ley by an addition of caustic lime into caustic potash and to boil the precipitate with it, thus producing potassium sulphide. By this method the wood ashes now thrown away can be used to advantage.

The precipitate, when boiled with caustic soda, shrinks considerably

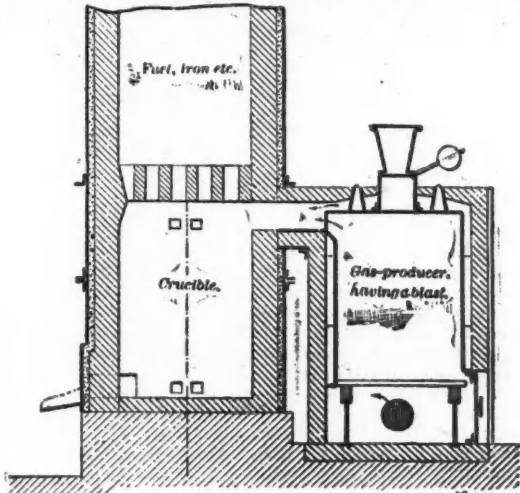


FIG. 33.—The Dufrené System.

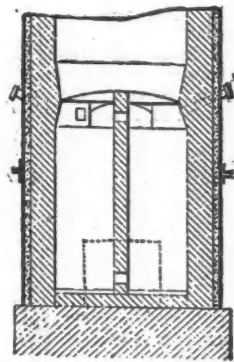


FIG. 34.—Section through the Cupola.

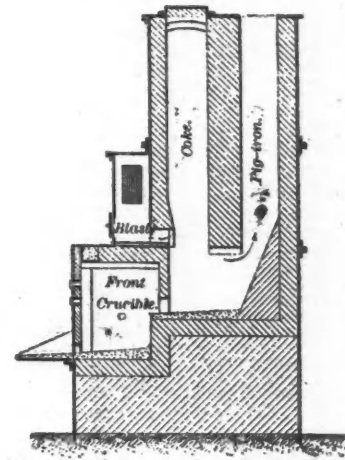


FIG. 36.—The Krigar Cupola, having two Shafts.

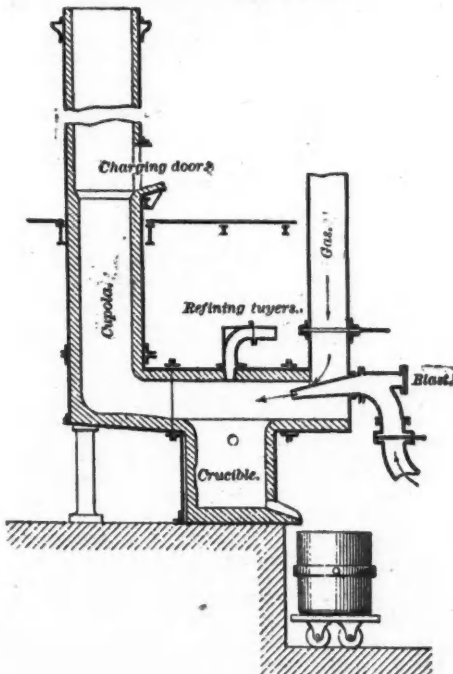


FIG. 35.—The Besson Cupola.

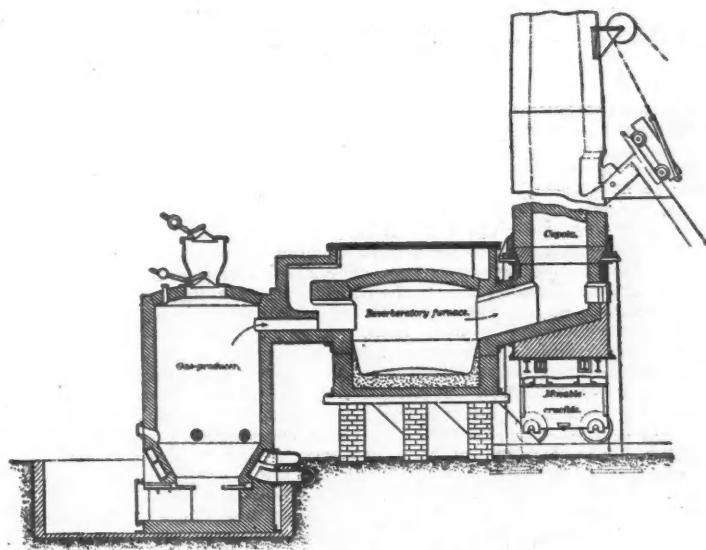


FIG. 37.—The Riley Cupola and Open-Hearth Furnace.

1888," ought to read "1887"; page 191, "cost of a roasting per ton, 67 cents, Mexican currency," ought to read "\$3.67, Mexican currency.

THE PRECIPITATE.

If we consider the nature of the ore, we cannot expect the precipitate to be very rich in silver. In the following table I give analysis of two different lots of roasted precipitate.

	Per cent	Per cent		Per cent	Per cent
Gold.....	0.04	0.014	Zinc.....	4.30	13.86
Silver.....	19.00	21.60	Lime.....	3.88	3.62
Lead.....	30.64	21.10	Sulphuric Acid.....	6.10	6.18
Copper.....	11.55	4.44	Sulphur.....	14.90	19.37
Cadmium.....	3.45	1.20	Insolubles.....	5.45	4.96
Iron.....	0.72	2.68			

\* The employment of liquid iron in reverberatory furnaces has often been tried, especially for puddling, but it has always failed, in consequence of the rapid wear of the bottom of the furnace. Recently, again (1885), the Dujardin system has been patented in Belgium, and this puddling furnace appears to have worked without difficulty and economically. † Mentioned by M. H. Bessemer at the Autumn Meeting of the British Iron and Steel Institute, 1885.

in volume, and is as heavy as the burned precipitate. I strongly recommend to substitute the roasting of the precipitate by either of these methods, but on account of some more pressing work of construction in other parts of the mill, the required plant was not yet erected when I left Parral, but will be erected in the near future.

USING CUPRIC CHLORIDE FOR BADLY ROASTED CHARGES.

I have mentioned above that if an insufficiently chloridized ore is treated during base-metal leaching with a dilute solution of cupric chloride it has a very beneficial effect, and that in some instances I experienced with the Del Oro ore a further extraction of 34 to 40 per cent of the silver.

Thirty-five pounds of blue stone, and about 70 pounds of salt, boiled by steam for about 15 or 20 minutes, gave a sufficient quantity of cupric chloride for a charge of 8 1/2 tons, at a cost of 60 cents per ton of ore.

Blue stone, 35 pounds, at 12c.....	\$4.20
Salt, 70 pounds, at 17c.....	.83
	\$5.03 1/3 = \$0.60 Mex. currency.

At the Silver King I frequently increased the chlorination of badly roasted charges by moistening the ore with base-metal solution containing cupric chloride.

The cupric chloride is either added to the water contained in the tank into which the dry and hot ore is dumped, or it is added during base-metal leaching. In the latter case it is better to apply the copper solution after the main portion of the base-metal salts has been leached out, say about one hour after commencing base-metal leaching and to add it gradually in order to penetrate the whole charge. To about 6 or 8 inches of water standing above the ore, one quarter of the prepared copper solution is added, stirred, and allowed to sink through the ore. As soon as the liquid is level with the top of the ore the outlet under the filter is closed, and again 6 to 8 inches of water allowed to flow into the vat, to which the second quarter of the copper solution is added. This is repeated until the copper solution is used up. Then the charge is washed in the usual way.

The first method is quicker and less troublesome, but in this case leaching from below should not be neglected.

The solution from the Del Oro ore treated in this way left the tank colorless with only a slight reaction for copper, showing that the cupric chloride was decomposed by passing through the ore.

I am much inclined to believe that if the roasted ore of the Yedras mine were treated in this way, very good results could be obtained without reducing the fineness of the precipitate so much as is done at present by the use of the extra solution.

#### COST OF LIXIVIATION.

The works at Parral had two leaching plants, one in connection with the modified Howell furnace, the other in connection with the Reverberatory furnaces. Separate accounts were kept for each. The following figures refer to the plant with the Howell furnace, in which no other ore was worked but that roasted in the Howell furnace. For the consumption of sulphur, however, no separate account could be kept, and the quantity of sulphur used per ton was calculated from the total amount of sulphur consumed, and the total number of tons of ore leached in both mills. It gave a consumption of 7 pounds per ton of ore. One man was roasting the precipitate furnished by both plants: in the statement, therefore, only one-half of his wages are charged.

Labor for charging and discharging.....	\$ 1.00
2 leachers, at \$1.00.....	2.00
1 man preparing calcium sulphide.....	.75
Sulphur, 50½ pounds, at 6c.....	3.57
Lime, 180 pounds, at 0.5c.....	.90
1 man roasting precipitate, \$1.00 (one half).....	.50
Wood for roasting precipitate.....	.50
Management, office, mechanics, assay office.....	1.78
Oil, light, filter cloth, shovels.....	1.50
Steam for pump and sulphide solution was charged to roasting.....	.....

\$12.50 : 8.5 = 1.47

Or cost of leaching per ton of ore.....\$1.47, Mexican currency.

A reduction in the cost will be effected if the precipitate is boiled with caustic soda instead of roasting it.

The item management, office, etc., represents one third of the cost for 100 tons per day, calculated for 8½ tons, as explained in the statement of cost of roasting in the modified Howell furnace.

#### TOTAL COST OF REDUCTION, NOT INCLUDING STAMPING.

Roasting in the reverberatory.....	\$3.67
Lixiviation.....	1.47

\$5.14 Mex. currency per ton of ore.

#### CADMIUM.

While I was making some experiments in the muffle, I noticed that under certain conditions heavy brown fumes emitted from the ore, which led me to the supposition that the ore must contain cadmium in large quantities. Further investigations and a subsequent analysis of the ore proved this to be correct. An examination of the base-metal solution showed that the same contained considerable of this metal, likewise the precipitate. The first and most concentrated part of the base-metal solution gives with calcium sulphide a dark colored precipitate on account of some copper, but the copper soon ceases to show and the precipitate containing now mostly zinc and cadmium is of a light yellow color. The cadmium leaches along with the zinc, and as long as there is zinc in the solution cadmium will be found.

The fact that the cadmium is brought in solution by the regular operations of the process for extracting the silver, permits its extraction as a by-product at a very small cost. The analysis showed that the base-metal solution of the Del Oro ore is remarkably free from metals which are precipitable by zinc. If, therefore, the more concentrated part of the base-metal solution is conveyed in a properly arranged tanks, like those devised and recommended by Mr. Stetefeldt for precipitating the copper and silver of the base-metal water, with scrap iron, and metallic zinc is introduced, it will precipitate cadmium, copper and silver. The base-metal solution is acid enough, still an addition of some sulphuric acid hastens the process. It is more profitable to manufacture cadmium sulphide than to produce the metal. The metallic precipitate, after being washed, is boiled with diluted sulphuric acid. Cadmium dissolves, while the copper will remain as a sediment, so will lead in case it is present. The solution is decanted, filtered, and the cadmium precipitated as cadmium sulphide with sulphureted hydrogen. Cadmium sulphide is a brilliant and valuable paint. Experiments on a large scale showed that from 2 to 3 pounds of cadmium sulphide can be produced from the base-metal solution resulting from each ton of ore, which, when the new mill of 100 tons daily capacity is erected, will give a production of 200 to 300 pounds per day. Inquiries in London brought the assurance that there is quite a ready market for it.

The nicest orange yellow of cadmium is obtained by precipitating with sodium sulphide, but the solution has first to be made alkaline with caustic soda.

#### TROUGH LIXIVIATION.

I have mentioned that the Bosque Mill is very inconveniently arranged. One of the main inconveniences is the want of grade, requiring the precipitation tanks and sump to be sunk in the ground. The locality and the arrangement of the mill, therefore, did not permit the erection of a complete system for trough lixiviation, and I had to make the experi-

ments with only one circuit of six tanks. I was obliged to use the same trough and tanks for base-metal and afterward for silver leaching. The washed ore had to be removed from the tanks and packed to the head of the trough for silver leaching. Notwithstanding this inconvenience, the experiments gave very interesting results, and decided some questions in dispute.

By a triangular trough, 138 feet in length, ¼ inch fall per foot, with a feed-box at the upper end, and intersected by five square boxes, the pulp could be conveyed to any of the six tanks of the circuit. The tanks were connected by pipes inserted near the rim. The whole arrangement was similar to that described in the ENGINEERING AND MINING JOURNAL of September 10th, 1887, and in my paper on Trough Lixiviation, Boston meeting of the American Institute of Mining Engineers, February, 1888.

#### BASE METAL LEACHING.

The ore used in this experiment was roasted in the modified Howell furnace. It was charged into a running stream of water at the rate of 64 tons per 24 hours. The pulp passed through the whole length of trough in 55 seconds.

In order to find out how much of the base metal salts were dissolved during this short time, and to ascertain the required length of the trough, samples were taken at different places, dried and subjected to a thorough washing in the laboratory, with the following results:

Roasted ore before troughing contained 12 per cent in salts soluble in water.

1. The sample taken after the pulp passed the entire length of 138 feet still contained in salts soluble in water 4.9 per cent.
2. The sample taken after the pulp passed through 58 feet of trough still contained in soluble salts 4.5 per cent.
3. The sample taken after the pulp passed through 12 feet of trough still contained in soluble salts 3.6 per cent.

The above results are just in reverse order from what would be expected, but it was not possible to take the sample from the same portion of moving pulp, which may account for this irregularity. If we take the average of the three results we find that the pulp, after troughing, still contained 4.7 per cent of salts soluble in water, or, as the roasted ore before washing contained 12 per cent of such salts, that 60.8 per cent were extracted. This result shows that at least 60.8 per cent can be extracted while the pulp passes through 12 feet of trough, or in 4.7 seconds. Long troughs are, therefore, not essential for base metal leaching. In order to ascertain, if in tank lixiviation in the usual routine, a larger percentage of the soluble salts are extracted. I took a sample from a tub-charge, after the charge was washed for eight hours and ready for silver leaching. The outflowing water gave with calcium sulphide only faint white clouds, the usual indication that base-metal leaching is completed. The sample, after drying and weighing, was subjected to a second washing in the assay office, and the result showed that of the original percentage of soluble salts 61.7 per cent were extracted by leaching in the tanks, which is only 0.9 per cent more than in the trough.

In both cases about the same percentage of soluble salts are retained by the ore, which only by a prolonged leaching, can be removed. They are not heavy metal salts, but principally sodium sulphate and sodium chloride. In the present case mostly sodium sulphate for an analysis of the stock solution, after three months' use, showed it to contain only 0.098 per cent chlorine, while the white clouds produced by an addition of calcium sulphide proved to be gypsum.

#### TIME REQUIRED FOR BASE-METAL LEACHING.

Though the dissolving of the base metals is almost instantaneous, considerable time is consumed in preparing the charge for silver leaching, caused principally by the time required to press out the base-metal solution by water; this time I found to be three hours and twenty-five minutes for a charge of 8.39 tons. However, the total time is still three hours and thirty-five minutes less than in tank lixiviation.

The time is divided as follows:

#### IN TROUGH LIXIVIATION.

	Hours.	Min.
Leaching and filling the tank.....	3	6
To drain remaining solution from top of the ore.....	3	34
To press out base-metal solution by water.....	3	25
"    "    water by hypo-solution.....	1	20
Total time.....	8	25

#### IN TANK LIXIVIATION.

	Hours.
Charging.....	3
Base-metal leaching.....	8
Pressing out with hypo-sulphite solution.....	1
Total.....	12

#### THE QUANTITY OF WATER REQUIRED.

Sufficient water had to be used to make the pulp move freely through the trough, and to produce a sufficiently dilute base metal solution in order to lessen its dissolving action on the silver chloride. The results were attained with 702 gallons per ton of ore, which is equivalent to about 1 weight of ore to 3 of water. When the tank was charged, and clean water turned on to press out the solution, the speed of filtration was 12 inches per hour in a tank of 10 feet 2 inches diameter, which is equivalent to 2065 gallons in 3 hours 25 minutes for a charge of 8.39 tons, or 246 gallons per ton. After silver leaching, it took 2 hours 30 minutes to press out the hyposulphite solution. Summing up, we find the total consumption of water as follows:

	Gallons.
In troughing.....	702
Pressing out the base metal solution by water.....	246
"    "    hyposulphite solution by water.....	181
Total consumption per ton.....	1,129 = 150.5 cubic feet

In properly arranged trough lixiviating works, and where water is scarce, the difference in the level between the base-metal and silver department should be great enough to permit the use of the base-metal solution for sluicing the tailings from the silver settling vats. In tank lixiviation we showed the consumption of water to be 703 gallons per ton. If the tailings are removed by sluicing we will have to add at least 240 gallons per ton of ore, giving a total consumption of 943 gallons, or

125.7 cubic feet. These figures show an increased consumption of water in trough lixiviation of 186 gallons, or 24.8 cubic feet per ton of ore.

QUANTITY OF SILVER DISSOLVED BY THE BASE-METAL SOLUTION.

In one of my articles on trough lixiviation, I pointed out as one of the advantages of this system, that by producing at once a sufficiently dilute base-metal solution that it will not contain any silver and can be allowed to run to waste. Mr. Stetefeldt called this a rather bold statement to put in black on white, still the results of my experiments, which were executed on a large working scale, prove my assertion to be correct.

One liter of the 702 gallons of base-metal solution was precipitated with calcium sulphide. The precipitate after fluxing and treating like a common ore assay returned not more than 0.0002 grams fine silver. If one liter contains 0.0002 grams silver, 702 gallons will contain 0.532 grams, which is the total amount of silver dissolved from the whole charge of 8.39 tons of ore, or 0.06 grams, equal to 0.002 ounce silver per ton. This is practically nothing, and the wash-water can therefore be allowed to run to waste, without causing any perceptible loss in silver.

SILVER LEACHING.

After three tanks were filled, and the base-metal solution was pressed out with water, and the water with a 0.38 per cent sodium hyposulphite solution, the ore was allowed to drain. Then the ore was shoveled out and removed for silver leaching to the head of the trough. Being at that time rather late in the evening, the ore, saturated with hyposulphite solution, was left in a pile over night. The next morning, however, it was found that some of the silver chloride was decomposed during the night by the action of caustic lime, and that the value of the chlorination test tailings had increased from 5.24 ounces to 9.03 ounces per ton. Taking the tailings value of 9.03 ounces per ton as basis, the experiment was continued. The measured stream of solution was kept uniform, while the rapidity of charging the ore was changed according to the desired proportion. In order to ascertain the proper length of trough, samples were taken at different places with the following results:

Assay office chlorination tailings of the pulp, 9.03 ounces per ton; strength of solution, 0.38 per cent; proportion, one weight of ore to five of solution; rate of working, 38 tons of ore per day.

1. Sample taken from spout of feed box when entering the trough: Tailings, 9.80 ounces per ton.
2. Sample taken after passing 12 feet of trough: Tailings, 8.13 ounces per ton.
3. Sample taken after passing 70 feet of trough: Tailings, 8.85 ounces per ton.
4. Sample taken after passing 100 feet of trough: Tailings, 8.13 ounces per ton.
5. Sample taken after passing 120 feet of trough: Tailings, 8.60 ounces per ton.
6. Sample taken after passing 138 feet of trough, while dropping in tank: Tailings, 8.60 ounces per ton.

This experiment gave the very surprising information that actually only a few feet of trough are required to produce a perfect dissolving of the silver chloride. It shows that by passing through 12 feet of trough, or in 4.7 seconds, the extraction is complete, and that longer troughs are therefore not necessary. This is of importance, as it simplifies the construction of trough lixiviating works and reduces the required grade.

OTHER PROPORTIONS, WORKING THE SAME LOT OF ORE.

7. Proportion, 1 ore to 3.4 solution; working rate, 55.8 tons per 24 hours; tailings, 7.89 ounces per ton.
8. Proportion, 1 ore to 2.4 solution; working rate, 84.5 tons per 24 hours; tailings, 9.56 ounces per ton.
9. Proportion, 1 ore to 10 solution; working rate, 19.05 tons per 24 hours; tailings, 9.09 ounces per ton.

These results show that the proportion of 1 ore to 3.4 solution gave the best result, the tailings being 1.14 ounce per ton poorer than the chlorination assay called for.

A second series of experiments were made, and particular attention was paid to avoid the decomposition of silver chloride by caustic lime. The charges were subjected to silver leaching soon after being saturated with hyposulphite solution.

Chlorination test tailings, 5.25 ounces per ton.  
Strength of solution, 0.50 ounce per ton.

1. Proportion, 1 ore to 3.4 solution; tailings, 3.59 ounces per ton.
  2. Proportion, 1 ore to 6 solution; tailings, 3.82 ounces per ton.
- These are very satisfactory results, the tailings are as poor, in fact poorer than those obtained in tank lixiviation after four days silver leaching. The proportion 1 to 3.4 proved again to be sufficient, producing tailings 1.66 ounces poorer than the chlorination test called for, the quantity of solution required in trough lixiviation is therefore very moderate, much less than I anticipated, and by far less than that required in tank lixiviation.

QUANTITY OF SOLUTION REQUIRED.

By using the proportion of 1 : 3.4 we need 108.8 cubic feet, or 816 gallons of solution to circulate for each ton of ore. In tank lixiviation the required quantity of solution I have shown to be 658 cubic feet, or 4935 gallons for each ton of ore, or about six times as much as in trough lixiviation.

TIME REQUIRED FOR SILVER LEACHING.

	Hours.	Min.
Troughing and filling the tank.....	3	36
Draining the solution from the top of the ore.....	1	34
Pressing out the solution with water.....	2	30
Total time.....	6	4

In order to compare the total time required by the two methods for each charge of ore, from the time it enters the leaching works until it is ready for discharge, I will recapitulate the following:

IN TANK LIXIVIATION.

	Hours.
Charging.....	3
Base-metal leaching.....	8
Pressing out the water by solution.....	1
Silver leaching.....	36
Pressing out the solution by water.....	1 1/2
Total.....	100 1/2

IN TROUGH LIXIVIATION.

	Hours.	Min.
Base-metal leaching and filling the tank.....	3	6
To drain the wash-water from top of ore.....	1	34
To press out the base-metal solution by water.....	3	25
To press out the water by hyposulphite solution.....	1	20
Silver leaching (sluicing with solution).....	3	36
Draining solution from top of ore.....	1	34
Pressing out the solution by water.....	2	30
Total time.....	15	5

To work a charge of the Del Oro ore by the trough system it takes 15 hours 5 minutes, while by tank lixiviation it takes 109 hours 30 minutes, or about seven times as long.

SEPARATING ORE FROM SOLUTION.

I did not experience any difficulties in obtaining clear solutions, neither in base metal nor in silver leaching. The tanks of the circuit which were not engaged in charging, etc., I used as filters. About three inches of tailings spread over the filter cloth are sufficient to produce a clear solution. The precaution, however, has to be taken that the outlet under the filter bottom is not opened until the tank is full of solution. By working at the rate of 55.8 tons per 24 hours the use of three tanks was sufficient to filter all the solution. Even the outlet of the tanks, which was under the operation of charging, could be opened after the tank was half charged, and clear solution flowed out. The ore did not pack as predicted by the opposers of trough lixiviation. The ore remaining only for a comparatively short time in the tank maintained its loose condition. While in tank lixiviation the rate of filtration during silver leaching was 8 1/2 inches per hour, in trough lixiviation I found it to be 12 inches per hour. The formation of slimes was very limited, and did not reach the thickness of one-half of an inch when, in rotation, the time came for a tank to be charged.

That the number of tanks required in trough lixiviation is much less than in tank lixiviation is apparent if we compare the leaching time of the two methods, the quantity of silver solution to be precipitated, and take in consideration the facility with which clear solutions can be obtained if the unengaged tanks are used as filters.

FINESSNESS OF THE PRECIPITATE.

The roasted sulphides contained 20.9 per cent of fine silver, while those obtained in tank lixiviation during the same week and from the same lot of ore contained only 17 per cent fine silver.

In the following table I recapitulate some of the more interesting figures:

	In tank lixiviation.	In trough lixiviation.
Quantity of water required for base-metal leaching including sluicing, per ton.....	943 gals.	1,129 gals.
Quantity of Hypo solution, which has to circulate for each ton of ore.....	4,935 gals.	816 gals.
Time required to treat one tank charge of ore.....	109 h. 30 m.	15 h. 5 m.
Total quantity of water required for 100 tons of ore per day.....	94,300 gals.	112,900 gals.
Total quantity of hypo solution per day to work 100 tons.....	493,500 gals.	81,600 gals.
Loss of silver in base-metal leaching per ton of ore.....	0.25 ounces.	Trace.
Extraction of silver in both methods the same.		

OFFICIAL REPORTS.

THE RIDGE COPPER MINING COMPANY.

The annual report of this company for 1888 will show the following results of operation:

The product of mineral was 66,787 pounds, which, at 76 1/4 per cent gave 50,924 pounds of fine copper, from which was realized.....	\$8,577.67
Expenses of all kinds were.....	6,600.57
Leaving the profit of the year.....	\$1,977.10
Cash on hand January 1st, 1888.....	13,500.80
Total assets.....	\$15,477.90
Expended on mill, at surface, and in repairing shafts and shaft houses.....	9,656.76
Leaving cash balance January 1st, 1889.....	\$5,821.14
Other assets—	
Supplies at mine and tools.....	\$4,941.21
Machinery.....	12,110.60
Total assets.....	\$22,872.35

The balance sheet shows: Assets—treasurer's accounts, \$5936.07; cash at mine, \$12.43; supplies, \$1686.65; total, \$7635.15. Liabilities—unpaid dividends, \$215.50; drafts outstanding, \$1598.51; total, \$1814.01; balance assets, \$5821.14. During the year the machinery has been repaired thoroughly, new steam pumps and boilers have been put in; the stamp mill has been overhauled and placed in good working order; No. 2 shaft has been entirely rebuilt, as have also the shaft houses, and the property is in good condition. The Ontonagon & Brule River road will run within a mile and a half of the mine, and the directors are confident that the mine can be operated profitably during the current year.

THE HORN-SILVER MINING COMPANY.

This once great mine has been the cause of many disappointments, the greatest of which was the shameful betrayal of trust by its former "eminently respectable" officers. The story has been frequently told, and need not be repeated, but to make it complete we quote the report to the shareholders just issued by Mr. Allen C. Washington, now President of the company.

The mine, though not in bonanza, has some ore and a possibility of finding more, and is actually earning a modest dividend, while it has the very respectable amount of \$131,000 in cash on hand with which to make exploration. The future of the property depends on what may yet be found and not on the profits which may be made from clearing up the remains of the old bonanza; it is, therefore, in the highest degree desirable that exploration be prosecuted energetically, but not blindly. Possibly the advice of some experienced mining expert such as Prof. Joshua Clayton, who was so successful in finding the continuation of the Drumlummon ore-body, might render this exploration work more economical and productive.

It should certainly be the policy of the directors of the company to

maintain a good reserve fund with which to carry on this important work, and not accede to the natural desire of stockholders to divide all the earnings in dividends.

Every mining engineer knows how much money is wasted in blind or injudicious explorations underground, and we may safely assert that no such examination as can be made between the time of the arrival of the train in the morning and its departure in the afternoon," as stated in the Superintendent's report, is of the least use; in fact, such an inspection is a pure waste of money and may lead to much more harm than good.

The following extracts from the report will place the essential facts on record:

"The President and Board of Directors herewith respectfully submit their annual report for the year ending December 31st, 1888.

"On assuming control of the company, which was the result of the election held at Frisco, Utah, October 10, 1888, our first effort was to acquire such information regarding the financial condition of the company and the physical aspect of the mine as would enable us to determine on a policy that would conduce to the best interest of all concerned.

"Notwithstanding the company had ceased declaring dividends in 1884, there had apparently been no desire or endeavor on the part of the former management to retrench or decrease expenses except in one single instance. The Secretary, who, up to October 31st, 1887, had been receiving \$5000 per annum, was at that time retired, and the duties of his office were combined with those of the Assistant Treasurer; but it was after minority representation had been secured in the Board of Direction, as, during the period from 1884 to October, 1888, when the present management took charge, the manager in Utah had been drawing a salary of \$12,000 per annum, and the subordinates in the office at Salt Lake and at Frisco in like proportion, making a total yearly expenditure in that direction of over \$22,000 in Utah alone.

"The New York office was run on the same high-pressure principle. For the year 1884 the rent, salaries and clerk hire were \$11,696.81; 1885, \$10,545.03; 1886, \$12,650.88; 1887, \$10,635.02; 1888, \$4,142.92 (the decrease for 1888 being caused by retirement of Secretary). We also found that all the officers were appointed for the year terminating December 31st, 1888, and consequently we were legally bound to retain them until that date, but on the expiration of the term named an entire change was made.

"By and with the advice of the three resident directors in Utah, the services of Mr. P. T. Fernsworth, of that territory, a gentleman who is thoroughly competent and experienced in mining matters, were secured at a salary of \$6000 per annum, and that, combined with other reductions, has decreased the yearly expenses for the future in Utah about \$10,000.

"In New York, an office which answers all purposes has been rented for four hundred dollars per annum, and a secretary appointed at the rate of \$1000, making a total of \$1400 for rent and salaries, and it is the opinion of your Board that the interests of the company will be equally as well served.

"In regard to the minority representation before named, we consider it proper here to state that for the year 1887 the mine was run at a loss of \$3268.62, while for the year 1888, when the minority was represented, there was a profit of \$25,608.99, and we consider said favorable showing to be due entirely to said minority representation; and now that we have sole charge we have every reason to believe that for the current year the showing will be still more favorable, as the months of January and February together give a profit of \$15,000.

"The items, 'Accounts due Company,' consist of various amounts (being principal and interest) which appear on the books of the company as 'Call Loans,' and were made by former officers of the company without authority of the Board of Directors at different times between September 20th, 1881, and June 9th, 1885.

"On December 31st, 1888, the several accounts stood as follows: No. 1, \$2,248.58; No. 2, \$5,397; No. 3, \$11,296.95; No. 4, \$3,761.08; No. 5, \$3,906.08; No. 6, \$376,625.64; total, \$398,426.30.

"For items Nos. 1 and 2 the company have no collaterals. For items Nos. 3, 4, 5 the collaterals are of doubtful value. Item No. 6 was originally for a larger sum, and at the dates the loans were made and up to January 18th, 1887, the company had no security whatever, but at that time an assignment of certain mining properties in Nevada was given to the company as security.

"On or about November 23d, 1887, \$25,000 in cash was paid on account of said loans, and certain mining properties in Idaho with three notes aggregating \$30,000, which by their conditions formed a lien on certain lands in Kentucky, were turned over to the company as additional security. Two of the notes, amounting to \$45,000, were payable November 21, 1888, and the remaining one, for \$35,000, is payable November 21, 1889. The two due on November 21, 1888, were not paid at maturity, but the security is considered ample, and steps are being taken to enforce payment.

"The Idaho property was sold on August 10th, 1888, for \$75,000, \$30,000 being paid in cash, and the balance (\$45,000) was to be paid on the 1st day of January, 1889, the deed in the meantime to be held in escrow by Messrs. Wells, Fargo & Co until such payment was made. On the date named the amount was paid, the deed delivered and the money covered in the treasury of the company.

"In regard to the Nevada property, it is believed to be valuable, but nothing certain is known. The directors are trying to realize on it, but thus far without success. Suits, however, have been instituted, and are now pending against the principals, and also the directors who were in office at the time the loans were made, to recover the amounts due.

"For a statement in detail of the work performed in the mine for the portion of the year to December 17th, 1888, we respectfully refer to the accompanying report of Mr. H. C. Hill, the former manager.

"In conclusion, we beg to assure the shareholders that our aim will be to conduct the affairs of the company as carefully and economically as will be consistent with good management and to your interest; and we propose to issue every quarter, commencing in April, a statement showing the financial condition of the company for the previous three months; but if, between those periods, any shareholder should desire more special information regarding the same, by calling at the office, No. 56 Broad-

way, Room 50, New York City, it will be fully, freely and cheerfully furnished."

We have already given in our issue of January 13th a full abstract of the report of Mr. Harry C. Hill, late mine manager of the company.

ORE EXTRACTED AND SHIPPED JANUARY 1ST, 1888, TO JANUARY 1ST, 1889.

On hand January 1st, 1888, 155,133 gross tons; extracted 4178 8.1 gross tons; shipped, 4334,203 gross tons; average value per ton ore, \$27.13; average cost per ton extracted, \$18.45; 4163 pit cars ore hoisted, 6177 days' work on ore extraction, 4772 days' work on dead work, 2457 days' work on surface, 848 days' work on contract, 71,51 feet timber received, 59,856 feet plank received, 10 railroad cars stone coal received, 14,100 tons; 294 railroad cars Horn-Silver ore shipped, 76 railroad tanks water received.

#### FINANCIAL STATEMENT.

Cash balance from last report, \$3,642.30.  
RECEIPTS, 1888.—Ore sales: Gross sales for year, \$117,589.47; less freights, etc., \$11,595.38; total, \$105,994.09. Bullion sales: Sale of fine d. at, etc., from Francklyn smelters, \$2,35.38. Works and plant at Francklyn: Sale of blower from smelter, sundry rents received, etc., \$1,769.26. Store at Frisco: Surplus funds from it, \$5,095.25. Chicago refinery: Sale of sundry lead, silver and supplies, \$2,617.37. Suspense account: Proceeds of sale of property in Idaho, less sundry payments for taxes, labor, etc., \$71,564.48; total, \$189,398.93. Total receipts, \$223,041.23.

PAYMENTS, 1888.—Mining: Labor, supplies, timbering, dead work and expenses, \$30,761.78. Smelting: Labor, supplies, etc., \$1534.73. General expenses: Manager, clerk, etc., Frisco and Salt Lake City, \$17,214.52. Exchange: On money transfers, \$50. Chicago refinery: Insurance, taxes, etc., on real estate, \$1,757.30. New York office, \$10,465.52; total work expenses for year 1888, \$91,733.85.

Balance, cash on hand: J. T. Little, Treasurer, Salt Lake City, \$85,001.51; F. Honkamp, Chicago refinery, \$154.85; First National Bank, New York, \$46,048.80; petty cash, \$52.22; total, \$131,257.38. Total payments, \$223,041.23.

#### ASSETS OF THE COMPANY IN ADDITION TO THE MINE.

Outstanding amounts due to company, \$398,426.30; bills receivable, notes secured by real estate, \$50,000; estimated value of stock on hand at the mine and store, \$36,797.21; works and plant at Francklyn, cost \$179,065.64; hoisting works at mine, cost \$52,134.12; refinery at Chicago, cost \$68,436.04; real estate at Frisco, cost \$34,755.54; cash on hand, as per statement, \$131,257.38; total, \$980,872.23.

Liabilities, none.

#### PROGRESS IN SCIENCE AND TECHNOLOGY IN JAPAN.

In his address on occasion of the third graduation ceremony of the Imperial University of Japan, the President, Mr. H. Watanabe, presented a concise outline of matters related to that institution which will interest all who note the progress of the higher education in the far East. The *Evening Post* gives the following summary. The College of Law, previously confined to the English and French divisions, has been enriched by the addition of a German division. Instruction in legal court practice is given gratis to students by eminent members of the profession in Tokio. Almost all of the graduates in law will receive appointments in the imperial legal courts. The law college now instructs more than 80 students.

The curricula in the College of Medicine are now nearly complete and include the addition of a new course of pharmacy. Lectures and practical instruction in nursing in the College Hospital were given by Miss Agnes Vetch, a scientifically trained English nurse. Advantages are now to be offered for the study of forensic medicine. Some months ago, on the occasion of a visit of Her Majesty the Empress to the University and its hospital, she inspected all the wards and operation rooms and made inquiry as to the diseases of almost every patient. A grant of 300 yen made by Her Majesty at that time is devoted to providing extra accommodation for free patients, thus relieving the sick poor and at the same time offering greater advantages to the course of clinical medicine and surgery. Original investigations conducted in the various institutes of the medical section have been published in the journal of the College.

Perhaps the outlook of the Engineering College is the most satisfying. The construction of new engineering works and appliances throughout Japan is increasing to such an extent that the graduates of this college are insufficient to meet the demands for properly qualified professional men. Courses in sanitary engineering and the technology of arms and explosives have recently been added to curricula already very full. New buildings in the university compound just completed for the Engineering College are now ready for occupancy. Of the thirty-five graduates of this college, thirteen are in civil engineering, two each in mechanical engineering, naval architecture and electric engineering, one in architecture, eleven in applied chemistry, and four in mining and metallurgy. In the Literature College, only two students graduate, one in philosophy and the other in Japanese literature.

In the College of Science many important researches have been carried out. Professor Knott and his assistants have been busy with a determination of the elements of magnetic force in the empire. For the purpose of anthropological investigations, the *hyaku ana*, or one hundred excavations, as they are popularly known, have been inquired into, with encouraging results. There were found between two and three hundred of these, and several human relics were obtained—gold rings, swords, old bits of earthenware, etc. These are in Yoshimi; and elsewhere, many old tombs were searched and valuable archaeological specimens procured.

In furthering astronomical ends, the Japanese officials have made a wise move in the consolidation of the three government observatories at Tokio into one. This is known as the Imperial Tokio Observatory, and is attached to the Mombusho, or Department of Education, with Professor Terao as director. It is thus under the control of the University, and its site is that heretofore known as the Imperial Naval Observatory, in Azabu, whither the instruments and apparatus of the two other former observatories are removed. The principal telescopes are of the best German and English construction. The total number of students of the University, including elective and special students, is now about eight hundred, and more than two hundred scholarships, for the most part on the loan system, are available.



THE PRODUCTION OF COAL IN THE UNITED STATES IN 1888.

By Charles A. Ashburner, Assistant in Charge of Coal Statistics.

The following statistics have been compiled principally from incomplete returns received from State officials, from the operators of individual coal mines, and from railroad agents. They are presented in this brief preliminary report as provisional estimates in advance of the full and complete returns which will appear in the final report, "Mineral Resources of the United States, 1888."

The total production of all kinds of commercial coal in 1888 was 138,515,744 short tons (increase over 1887, 14,500,499 tons), valued at the mines at \$200,534,306 (increase, \$26,938,310). This may be divided into Pennsylvania anthracite, 43,578,000 short tons (increase, 4,071,745 short tons), or 38,909,000 long tons, including 88,145,718 long tons shipped by the railroads and canals, and reported by their statistician, Mr. John H. Jones; and 763,282 long tons sold to the local trade at the mines (increase, 3,635,558 long tons), valued at \$84,977,100 (increase, \$5,611,856); all other coals, including bituminous, brown coal, lignite, small lots of anthracite produced in Colorado and Arkansas, and 6500 tons of graphitic coal mined in Rhode Island, amounting in the aggregate to 94,937,744 short tons (increase, 10,428,744 tons), valued at \$115,557,206 (increase, \$21,326,454).

The colliery consumption at the individual mines varies from nothing to 8 per cent of the total output of the mines, being greatest at special Pennsylvania anthracite mines, and lowest at those bituminous mines where the coal-bed lies nearly horizontal, and where no steam power or ventilating furnaces are used. The averages for the different States vary from 2 to 6 1/2 per cent, the minimum average being in the Pennsylvania bituminous, and the maximum average being in the Pennsylvania anthracite region.

The total output of the mines, including colliery consumption, was: Pennsylvania anthracite, 41,579,000 long tons (increase over 1887, 4,000,253 long tons), or 46,563,000 short tons (increase, 4,479,803 short tons); all other coals, 9,795,744 short tons (increase, 10,903,884 tons), making the total output of all coals from mines in the United States, exclusive of slack coal thrown on the dumps, 145,363,744 short tons (increase, 15,388,157 tons), valued as follows: Anthracite, \$88,714,600 (increase, \$4,162,419); bituminous, \$119,414,206 (increase, \$21,410,559); total value, \$208,129,806 (increase, \$25,572,969). The above figures show a notable increase in 1888 over 1887 in the aggregate output and value of both anthracite and bituminous coal, although not as great an increase as occurred in 1887 over 1886 in the value of anthracite, or in the total tonnage of the bituminous coal.

PRODUCTION OF COAL IN THE UNITED STATES IN 1888 AND 1887.

States and Territories.	1888.			1887.		
	Quantity, Short tons.	Value at mines.	Per ton.	Quantity, Short tons.	Value at mines.	Per ton.
<b>Pennsylvania:</b>						
Anthracite.....	43,578,000	\$84,977,100	\$1.95	39,506,255	\$79,365,244	\$2.01
Bituminous.....	32,500,000	30,875,000	0.95	30,866,602	27,806,941	0.90
Ohio.....	11,950,000	11,114,000	0.93	10,301,708	9,096,848	0.88
Illinois.....	11,855,188	13,309,030	1.12	10,278,890	11,152,596	1.08
West Virginia.....	5,498,800	6,048,680	1.10	4,836,820	4,594,979	0.95
Iowa.....	4,842,220	6,304,110	1.30	4,473,828	5,991,735	1.33
Maryland.....	3,479,470	3,293,070	0.95	3,278,023	3,114,122	0.95
Indiana.....	3,140,979	4,397,370	1.40	3,217,711	4,324,604	1.34
Missouri.....	3,909,967	8,650,000	2.21	3,209,916	4,298,994	1.34
Kentucky.....	2,570,000	3,084,000	1.20	1,933,185	2,233,163	1.16
Alabama.....	2,900,000	3,335,000	1.15	1,950,000	2,535,000	1.33
Tennessee.....	1,967,297	2,164,026	1.10	1,900,000	2,470,000	1.33
Colorado.....	2,185,477	4,808,049	2.29	1,791,735	3,941,817	2.20
Kansas.....	1,850,000	2,775,000	1.50	1,596,879	2,235,631	1.40
Wyoming.....	1,480,487	4,811,538	3.25	1,170,318	3,510,954	3.00
Virginia.....	1,073,000	1,673,000	1.56	825,000	773,360	0.94
Washington.....	1,215,750	3,647,250	3.00	772,612	1,699,746	2.20
Indian Territory.....	891,000	1,737,450	1.95	688,911	1,286,632	1.88
New Mexico.....	635,042	2,063,887	3.25	508,034	1,524,102	3.00
Georgia.....	230,000	345,000	1.50	313,715	470,573	1.50
Utah.....	205,000	430,500	2.10	180,021	360,042	2.00
Arkansas.....	193,000	289,500	1.50	150,000	225,000	1.50
Texas.....	90,000	134,500	1.50	75,000	100,000	1.33
Michigan.....	65,000	104,000	1.60	71,461	107,191	1.50
California.....	85,000	340,000	4.00	50,000	150,000	3.00
Oregon.....	50,000	150,000	3.00	31,696	70,000	2.20
Dakota.....	25,000	43,750	1.75	21,470	32,205	1.50
Montana.....	41,467	155,501	3.75	10,202	35,707	3.50
Rhode Island.....	6,500	17,875	2.75	6,000	16,250	2.70
Nebraska.....	1,500	3,375	2.25	1,500	3,000	2.00
Idaho.....	600	2,700	4.50	500	2,000	4.00
Total, exclusive of colliery consumption.....	138,515,744	\$200,534,306	\$1.45	124,015,255	\$173,595,996	\$1.40
Colliery consumption:						
Pennsylvania anthracite.....	2,990,000	3,737,500	1.25	2,581,942	5,186,937	2.01
Bituminous, in all States and Territories.....	3,858,000	3,858,000	1.00	3,378,360	3,773,904	1.12
Grand total.....	145,363,744	\$208,129,806	\$1.43	129,975,557	\$182,556,837	\$1.41

THE ELECTROLYTIC SEPARATION AND REFINING OF METALS.\*

By Dr. G. Gore, F.R.S.

HISTORICAL SKETCH.

More than thirteen hundred years ago Zosimus mentioned the earliest known fact respecting the electrolytic separation of metals, viz., that by immersing a piece of iron in a cupreous solution it acquired a coating of copper. Ever since that time the same fact has been commonly observed by workers in copper mines, that their tools of iron or steel became coated with a film of copper by contact with the water percolating through the mines, the water holding in solution blue vitriol derived from oxidation of mineral sulphides of copper contained in the rocks. Paracelsus, in the years 1493 to 1541, and even Stisser, the professor of chemistry in Helmstadt, as late as 1690, believed that by this process the iron was changed into copper.

The discovery of chemical electricity by Volta and the invention of the voltaic battery as an instrument for producing it did not occur until about the year 1799. Wollaston soon afterwards observed that "if a piece of silver in connection with a more positive metal be put into a

solution of copper, the silver is coated over with copper, which coating will stand the operation of burnishing" (*Philosophical Transactions of the Royal Society*, 1801). About the same time Mr. Cruickshank passed an electric current from his voltaic battery through a solution of sulphate of copper, and found that the copper attached itself to the wire connected with the zinc end of the battery, and stated that the metal was "revived completely" (Wilkinson's "Elements of Galvanism," Vol. II., 1804, p. 54). In 1805 Brugnatelli also observed that when the current entered the liquid by means of a piece of copper, the copper was dissolved and then deposited upon the negative pole ("Annals of Chemistry").

In 1831 Faraday discovered magneto-electricity, or the production of electric currents by means of mechanical power acting through the medium of magnets, a discovery which enabled all the subsequent inventions and improvements in dynamo-electric machines to be made, and the refining of metals by electrolysis to become commercially possible on a large scale. When he made this discovery the electric current he obtained was so very feeble that he was barely able to detect it, and he remarked: "I have rather, however, been desirous of discovering new facts and new relations dependent on magneto-electric induction than of exalting the force of those already obtained, being assured that the latter would find their full development hereafter" ("Experimental Researches," para. 158). This prediction has since been abundantly verified.

In 1836 De la Rue observed that the copper deposited by the voltaic current in a Daniell's battery cell gradually became thicker, and might be stripped off in the form of a separate sheet of metal from the surface upon which it had been deposited. About the year 1839 Jacobi, of St. Petersburg, and soon afterwards Jordan, Spencer and others, made and published their experiments on electrotyping in copper, and thus made the process of depositing that metal familiar to the public.

From that time until the present, copper has been constantly deposited on a commercial scale as a coating upon various articles of iron, etc., in order to protect them; the electrolytic process has also gradually extended and been employed to form ornaments and other articles, until at length copper of more than one inch in thickness has been deposited, and copper statues weighing several tons have been formed by the process. Electro-deposited copper has also been frequently analyzed and found to be extremely pure—so much so that it has been employed in the Royal Mint to alloy with gold in making the standard coins of this realm. Its deposition on a large scale and great degree of purity, thus foreshadowed the electrolytic refining process.

The first actual commercial application of electrolysis to the refining of copper is to be found in a patent (No. 2838) granted to James B. Elkington (son of the late G. R. Elkington, the original patentee of commercial electro-silvering and gilding), November 3d, 1865, entitled "Manufacture of Copper from Copper Ore." In this process plates of crude copper are used as anodes suspended in "troughs charged with a nearly saturated solution of sulphate of copper," the cathodes or negative plates being formed "of pure copper, rolled very thin." As the crude copper dissolves, pure copper is deposited upon the negative sheets. The patentee proposed to use a series of depositing troughs, each containing a set of properly connected anodes and cathodes, the electrolysis being effected by a current obtained from a magneto-electric machine. The insoluble residue which falls from the anodes to the bottom of the liquid frequently contains "silver, some gold, and also tin and antimony."

In a second patent (No. 3120), taken out by the same patentee, October 27th, 1869, for the "manufacture of copper, and separating other metals therefrom," impure copper, and especially that which contains much silver, is cast with a "T-shaped head of wrought copper," to enable it to be conveniently suspended as a dissolving plate in the depositing vessel.

"These plates are placed in fire-clay jars, ranged longitudinally in troughs on a slightly-inclined, pitched, and otherwise prepared wooden floor, in the dissolving-house. Each jar has a hole in the bottom, closed by a wooden plug, and two holes in the sides, one low down and the other on the opposite side near the top, each jar being connected with the next lower one by a pipe or tube passing from the higher hole of the one to the lower hole of the other jar. The liquid current thus established between the solutions effects mixture of the layers of different density, maintaining all the liquids in the series of jars practically alike at top and bottom, notwithstanding the disturbing influence of the electro-deposition, which constantly tends to produce inequalities of density.

"The solution made use of is water saturated with sulphate of copper, a store of which is kept in a tank at the upper part of the depositing-room, whence it is admitted into the uppermost jars, and runs from jar to jar till all are filled. A solution may also be used obtained by boiling the deposit formed in the culvert or long flue by which the smoke from the copper furnaces is led to the high chimney.

"The tubes connecting the jars have clips attached to their india-rubber portions, acting as stop-cocks. When needful the clips are removed, so as to cause the solutions to mix, the dense layer from the bottom of one jar displacing the lighter portion from the top of another until the density throughout becomes equalized. The outflow is received in a tank at the lower end of the room, from which it is pumped back to the upper reservoir. The plugged holes at the bottom of the jars enable the latter to be emptied on the inclined floor, the liquid then flowing into the lower tank. The T-shaped heads attached to the plates enable them to be suspended in the jar, from horizontal copper bars having forks upon them. Interposed between the copper plates to be dissolved are suitably suspended receiving plates for the deposit of the electrolytic copper. The receiving plates of one jar are connected by a conducting strip of copper with the cast plates of the next jar, and so on throughout. The series being coupled up into a circuit, the terminals are connected with one or more magneto-electric machines. The silver originally contained in the copper of the plates set for solution separates as a sediment, and ultimately accumulates as a deposit in the tank below, after the repeated workings and emptying of the jars.

"Ores rich in silver are preferred as the source of cast copper for this treatment, since the silver is obtained as a bye product, without increasing the cost of obtaining pure copper from the impure metal."

These two patents of Mr. James Elkington contain the essential parts of the process of purifying copper by means of electrolysis, viz., employing slabs or thick plates of the crude metal as anodes; a series of

\* Extracted by permission of the Author from a forthcoming work on this subject.—*The Electrician*.

depositing vessels with the solution flowing slowly through the whole of them, in order to keep it uniform in composition; the use of electric currents generated by means of mechanical energy, and the collection of the valuable impurities in the form of a sediment at the bottom of the vessels. The only other essential circumstance remaining is that of the occasional purification of the electrolyte by evaporating it, and crystallizing out of it the sulphate of iron and other soluble salts which gradually accumulate.

This process was developed and carried out on a large scale at Pembrey, near Swansea. The works at Pembrey formerly belonged to Messrs. Elkington, Mason & Co., but have since passed into the possession of the Elliott Metal Company (Limited), Selly Oak, near Birmingham, and at the present time this refinery is one of the largest and most perfect existing.

Meanwhile, *i. e.*, during the gradual extension of electro-deposition of copper, the originally minute, but, nevertheless, extremely important fact and phenomenon of the production of an electric current by mechanical energy acting through the medium of magnetism, was developing slowly. This phenomenon when first discovered by Faraday in 1831 was so small as scarcely to be perceptible, and was first observed by him as "a sudden and very slight effect at the galvanometer" (Faraday's "Experimental Researches," Vol. I., p. 3). No sooner had Faraday published this seemingly unimportant effect than various experimentalists endeavored to obtain it upon a larger scale. Prof. Forbes, of Edinburgh, Nobili, Ritchie and others, as well as Faraday himself, quickly succeeded in obtaining electric sparks by means of the magneto-electric current. In 1832 H. Pixii invented and exhibited at Paris the first magneto-electric machine, and decomposed water by means of the current from it; this was followed in 1833 by Saxton's improved machine, and by that of Clarke in 1836; and on August 1st, 1842, was granted to J. S. Woolrich the first patent, No. 9,431, for a magneto-electric machine for commercial purposes. Woolrich's machine was for a long time used by Messrs. Prime, of Birmingham, for electro-silverplating.

Since that time the improvements in producing magneto-electricity have been numerous. In 1857 Werner Siemens invented his shuttle-wound armature; in 1860 Pacinotti developed his ring armature machine for yielding a continuous current, which formed the basis of Gramme's and other direct current machines. In 1866 H. Wilde further increased the power of the apparatus by using a soft iron electro-magnet instead of an ordinary steel one to produce the currents; in 1867 Siemens, Wheatstone and Ladd each separately observed the fact of self excitation by mechanical power, and developed the self-exciting machine; and in 1871 M. Gramme produced the first practical continuous current machine for commercial purposes. Alterations and improvements have since that time succeeded each other so rapidly that there exists now quite a large variety of machines for converting mechanical energy into electric current. The magnitude, weight, and speed of the machines have also increased, until there are some which require several hundred horse-power to drive them; others which weigh as much as 45 tons each, and some with armatures revolving at a speed of 9000 revolutions a minute. The efficiency of the machine has also been increased until as much as 96 per cent. of mechanical energy imparted to the armature is converted into electric power. With a single dynamo now as much as 30 tons of copper are deposited per week. Even now the limit has not been attained, or even conceived, to the magnitude and uses of the machine, and dynamos will probably yet be constructed equal in amount of energy to the largest steam engines, and their power be applied to a great variety of purposes, mechanical, thermal, and chemical.

At the present time the process of electrolytic separation and refining of metals is extending rapidly; it is carried on at Pembrey, Widnes, Swansea, Tyldesley (Lancashire); Milton, near Stoke-upon-Trent; Paris, Marseilles, St. Denis, Angoulême, Biche (Pas de Calais), Hamburg, Stolberg, Berlin, Moabit, near Berlin; Oker, in the Harz; Esleben, Burbach, near Siegen; Frankfurt-on-the-Main, Schaffhausen, Statthalterhütte, near Cologne; the Koenigshütte, in Silesia; Witkowitz, in Moravia; Stephanshütte, in Upper Hungary; Brixlegg, in the Tyrol; Ponte St. Martino, in Piedmont; Casazza, near Genoa; Pittsburg, Pa.; Milwaukee, Wis.; Bridgeport, Conn.; Omaha, Neb.; Ansonia, Conn.; St. Louis, Mo.; Newark, N. J.; Cleveland, O.; Longport, near New York; Santiago, Chili; Chihuahua, Mex., etc. At Messrs. Balbach's Works, Newark, N. J., sixty tons of copper are deposited and refined per week. Messrs. Bolton, at Widnes, and Messrs. Vivian, as well as Messrs. Lambert, at Swansea, are each depositing from forty to fifty tons per week, by currents from 5,000 to 10,000 amperes" (*Nature*, January 26th, 1888, p. 303). The "daily quantity refined at Oker is two and a half tons; and the total amount in Germany and Austria is about six tons daily." Messrs. Elliott & Co., of Pembrey, near Swansea, deposit nearly the largest amount—forty-five to sixty tons per week—in this country. I am informed from a direct source that the Bridgeport Copper Company, of Bridgeport, Conn., electrolytically refine "one million pounds of copper per month," or about 105 tons per week, "by means of three dynamos."

**New Russian Oil Fields.**—Mr. Ouspensky, a Russian engineer sent to Central Asia on a special scientific mission, reports that the oil wells at Penjakend, near Samarcand, in the Zerafshan Valley, contain large quantities of good oil.

**Chinese Railway.**—The Hong Kong and Shanghai Bank is reported to have made a loan of £450,000 at 5 per cent to the Chinese Government, for the purpose of constructing the railway line from Tientsin to Tungchow, close to Pekin, and the Viceroy of Canton has given a Chinese syndicate permission to run steamers on the West, or Canton River.

**The Electric Light in the Emperor's Palace at Pekin.**—The Emperor of China intends to introduce the electric light into his palace, for which purpose an engineer from the firm of Siemens & Halske, of Berlin, recently arrived at Pekin with the necessary material. The installation was to be completed before the Imperial wedding, which has just taken place. The installation had to be erected and tried in another place in order to ascertain whether the electric light is not imbued with a "supernatural power."

**A Norwegian Tunnel to Float Timber.**—A tunnel 8 miles long, through gneiss rock, is proposed to bring the waters of l'Oegeren See to Christiana, Norway. According to *La Semaine des Constructeurs* the tunnel will have a circular section nearly 16 feet in diameter and will run half full. The surface of the lake is 230 feet above the sea level, and its shores are surrounded by forests whose timber will be floated through the tunnel to the seaport. The water-power thus rendered available is estimated at 24,000 horse-power.

**The Edgar Thomson Steel Works Record.**—The Edgar Thomson Steel Works, Pittsburg, Pa., it is reported, are beating the record on outputs of steel at the present time. The first turn on the 7th inst., working eight hours, turned out 45 heats, or 463 tons. On the same day, No. 2 turn made 67 heats, the amount of steel being made at that time reaching 698 tons. On the 8th inst., the first turn, working 12 hours, made the unprecedented record of 71 heats, equal to 729 tons. The third eight-hour turn working on the 9th, turned out 30 heats, which is only a fraction less than 318 tons of steel. Every day's run increases the output, and within the present week some bigger runs are expected. The above record is the greatest in the world.

**Chemical Combination of Silica and Lime in Mortar.**—An examination tending to show the chemical union of lime and silica by long contact has been made by Mr. John Spiller, F. C. S., of England. A sample of ancient mortar was taken from the section of an old London wall recently laid bare in St. Martin's-le-Grand. From the fact that a large quantity (11 per cent) of silica could be dissolved out readily by caustic soda, and there being a deficiency of carbonic acid without any evidence of free caustic lime, the inference was drawn that silicate of lime was present, this body being the result of direct combination between the lime and sand in the course of many centuries. Samples of a London mortar about 100 years old and another of recent date contained 1.1 per cent or less of soluble silica—that is, only one tenth of the amount now actually found in the Roman mortar analyzed.

**Russian Lead Mines.**—The employment of lead in Russia is twice as great at the present time, according to the *Russian Journal de St. Petersburg*, as it was five years ago. In consequence of this, the Government has been obliged, since the commencement of 1888, to enforce the energetic working of the silver-lead mines of the Altai, of Nertchinsk, of the Kirghiz Steppe, and of the province of Tevek. As the product of several of these mines was found to be greatly reduced, in consequence of their exhaustion, new explorations have been made, in the hope of discovering fresh beds of lead ore, and these experiments have met with the most complete success. Quite recently, in the upper basin of the Kouban, and of the affluents of that river, beds of considerable wealth have been discovered. The richest is that of Catherininskoe, and this is to be the first of the new lead mines to be worked.

**Purification of Mercury.**—J. M. Crafts finds that mercury may be purified in large masses by the simple aspiration of air through it. He places the mercury in a glass tube 5 cm. in diameter and 1.5 m. long, lying on an inclined wooden support. The lower end is closed by a cork through which pass a funnel tube for the introduction of the mercury, and a stop-cock for its removal. The other end is put in communication with a water exhaust pump, and in 48 hours all the impurities will be found as a coherent powder in the upper end of the tube and the mercury can be drawn off practically pure. This powder is too voluminous in the case of mercury that has been used to amalgamate zinc to permit the process to be at once used for such metal. Zinc and lead were introduced into mercury, and, after purification by a current of air, it left no residue when distilled in a vacuum.

**Important Arizona Land Decision.**—Commissioner Stockslager, general land officer, Washington, D. C., has rendered an important decision in the Tumacacori and Calabazas private land claim in Arizona. He holds there is no authority for the reservation of 52,060 acres of land included within the preliminary surveys of said claim, for two reasons: (1st) That the land being within "Gadsden purchase" of 1853 is not operated upon by the act of July 22d, 1853, and of the treaty of Guadalupe Hidalgo of 1848. (2d) That "preliminary survey" of private claim does not of itself operate as a withdrawal of the surveyed lands from settlement and entry, even in cases covered by said act of 1854, the legal withdrawal being only of lands actually claimed or which shall be legally claimed. Under this holding nearly 3,000,000 acres of land in New Mexico and Arizona is in a state of unlawful reservation from settlement, by reason of excessive surveys made for the benefit of grant claimants, irrespective of the question as to the validity or invalidity of the claims themselves. Nearly all private claims in Arizona are within the "Gadsden purchase."

#### 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 MARCH 12TH, 1889.

- |          |   |   |
|----------|---|---|
| 399,255. | Condenser for Charcoal Kilns.                       | John Friedrich, Iron Mountain, Mich   |
| 399,262. | Blast Apparatus for Blast-Furnaces.                 | John M. Hartman, Philadelphia, Pa.  |
| 399,263. | Tuyere.   | John M. Hartman, Philadelphia, Pa.  |
| 399,375. | Magnetic Separator.                                 | James A. Burden, Troy, N. Y.  |
| 399,378. | Coking-Furnace.                                     | Gates A. Clark, Rochester, N. Y., Assignor to Clark's Coking and Smokeless Furnace Company, same place. |
| 399,379. | Coking-Furnace.                                     | Gates A. Clark, Rochester, N. Y., Assignor to Clark's Coking and Smokeless Furnace Company, same place. |
| 399,385. | Friction-Clutch.                                    | Daniel T. Denton, Soudan, Minn.   |
| 399,393. | Furnace-Filling Barrow.                             | Thomas Failer, Lebanon, Pa.   |
| 399,485. | Machine for Cutting Coal.                           | Thomas Bower, Hull; Robert W. Bower, Leeds, and James Blackburn, Woodlesford, County of York, England.  |
| 399,486. | Separator.  | James M. Bradshaw and William E. Meek, Table Rock, Colo.  |
| 399,496. | Method of Calcining Rock.                           | Granville E. Carleton, Rockport, Me.  |
| 399,527. | Sponge for Reducing Gold and Silver and other Ores. | Abraham T. Hay, Burlington, Iowa.   |
| 399,528. | Process of Manufacturing Steel.                     | Abraham T. Hay, Burlington, Iowa.   |
| 399,529. | Process of Reducing Gold, Silver, etc.              | Abraham T. Hay, Burlington, Iowa.   |
| 399,590. | Centrifugal Amalgamator.                            | William White, Mount Vernon, Assignor to James B. Brewster and Richard Kelley, New York, N. Y.          |
| 399,600. | Ore-Crusher.  | John D. Copen, Denver, Colo.  |
| 399,611. | Manufacture of Iron.                                | Abraham T. Hay, Burlington, Iowa.   |
| 399,612. | Manufacture of Steel.                               | Abraham T. Hay, Burlington, Iowa.   |
| 399,634. | Coke-Oven.  | Michael Sandford, Gallitzin, Pa.  |

### THE METALLURGY OF STEEL.\*

By Henry M. Howe.

(Continued from page 239.)

Now that it is known that the hard spots in steel are usually due to segregation rather than to imperfect-mixing, mechanical agitation receives less attention than formerly. But segregation may be favored by imperfect mixing: for, since the tendency of a given element, say carbon, to segregate appears to increase as the proportion of that element present increases, so in a high-carbon streak in the molten metal due to imperfect mixing, the tendency towards the segregation of high-carbon fusible compounds may be exceptionally strong. In this way we may explain W. Richards' statement<sup>a</sup> that, after trying Allen's agitator, poling, and long repose in the converter to overcome the irregularity in carbon in his large ingots, he obtained almost complete uniformity as regards carbon by pouring from one ladle to another.

But this transfer may have hindered segregation simply by cooling the metal, so that it solidified more rapidly.

*How much segregation is usual?* From the foregoing we see that this question cannot be answered with confidence till we have the results of a great number of carefully studied cases: for the examination of a few spots at random may fail to detect the segregation. . . The cases in Table 96 are as a whole much worse than the average, for clearly the bad cases attract most attention: yet in 22 out of its 54 cases the segregation of carbon is not over 0.03% arithmetically. I can only say that, while we know that segregation is liable to be very serious, we believe that with reasonable care it may be kept within harmless limits in ingots of moderate thickness.

TABLE 99.—CRUSTS, ETC., ON CAST-IRON.

	Graphite.	SiO <sub>2</sub> .	TiO <sub>2</sub> .	Al <sub>2</sub> O <sub>3</sub> .	FeO.	Fe <sub>2</sub> O <sub>3</sub> .	MnOx.	CaO.	MgO.	K <sub>2</sub> O.	Sb <sub>2</sub> O
1...	4.55	75.95	1.12	4.90	3.56	.....	5.75	.92	.40	1.80	.08
2.....	45.69	5.59	3.56	.....	38.41	4.97	1.61	.66	.....	.....	.....
3.....	50.86	5.77	.....	.....	32.11	9.96	0.10	0	.....	.....	.....
4.....	22.84	4.45	0	.....	67.00	3.80	0.04	0	.....	.....	.....
5.....	94.87	.95	.....	.....	.98	.25	0	0	.....	.....	.....

	CRUSTS.				CAST-IRON ACCOMPANYING.				
	P <sub>2</sub> O <sub>5</sub> .	S.	V <sub>2</sub> O <sub>5</sub>	Cr <sub>2</sub> O <sub>3</sub>	Carbon.	Si.	Mn.	P.	S.
1.....	tr.	.05	.....	.....	3.310	3.27	.44	1.132	.018
2.....	.06	.....	1.82	.....	.....	0.51@0.84	.375	.55@.81	.035
3.....	.12	.....	1.15	.....	.....	.....	.....	.....	.....
4.....	.....	.....	.....	0.15	.....	.....	.....	.....	.....
5.....	.....	.....	.....	.....	.....	1±	.....	.....	.....

1. A yellowish white, readily detached, moss-like mass of threads or stemlets, filling cavities on the exterior of dark-gray, coarse-grained pig-iron, which were deep, irregular, and clearly formed by the escape of gas during solidification. The iron which contained this substance always smoked much in casting. The alumina may have come from the casting-beds. Ledebur, Stahl und Eisen, IV., p. 638, 1884.  
 2. Crust on pig-iron made at Pequest, N. J.; the vanadic acid is from a second specimen examined by Drown, Robertson and Firmstone, Trans. Am. Inst. Min. Eng., XII., p. 641.  
 3. Like crusts from Glendon, Pa., Idem.  
 4. Crusts similar to No. 2, from Pequest; G. Auchy, Idem, p. 644.  
 5. Crusts from pig-iron made at Riegelsville, Pa., B. F. Fackenthal, Jr., private communication, June 14, 1886.

#### CHAPTER XIV.

##### COLD WORKING, HOT WORKING, WELDING.

§ 269. COLD-WORKING IN GENERAL.—It is probable that all the forms of moderate permanent distortion of iron and steel in the cold, whether by stretching, compressing, or twisting, by cold-rolling, cold-hammering, wire-drawing, or otherwise, increase the tensile strength and hardness and still more the elastic limit,<sup>b</sup> while lowering the density: and that the changes which distortion

\* Copyright by the Scientific Publishing Company, 1887.

<sup>a</sup> Journ. Iron and St. Inst., 1886, I., p. 113.

<sup>b</sup> The proportionality limit is indeed temporarily lowered by stretching, but quickly rises again. Cf. § 270.

induces at least in the case of tensile strength and elastic limit continue at an ever decreasing rate for years after the distortion has ceased, and are accelerated and perhaps exaggerated by gentle heating, but are lessened or even wholly removed by heating to redness. I do not here refer to Wöhler-like indefinitely repeated stresses, which, even if below the initial elastic limit, may eventually destroy the piece.<sup>c</sup>

TABLE 102.—INFLUENCE OF TWISTING ON TENSILE STRENGTH OF WROUGHT-IRON AND SOFT STEEL.—Gilmore.

Number.	Description of test piece.				Tensile strength, pounds per sq. in. Before twisting.
	Material.	Round or square.	Thickness, inches.	Length, inches.	
1.	Wrought iron.	Round.	.....	8	54,180
2.	Steel.	Square.	.....	8	55,325
3.	Wrought-iron.	Round.	.....	12	57,360
4.	Wrought-iron.	Square.	.....	12	52,545

Number.	Tensile strength, pounds per square inch. After twisting.											
	1/2 turn.	1 turn.	1 1/2 turn.	2 turn.	2 1/2 turn.	3 turn.	4 1/2 turn.	5 1/2 turn.	7 turn.	11 turn.	18 turn.	
1.	.....	59,020	63,500	.....	64,750	65,000	.....	broken	broken	.....	.....	
2.	.....	57,265	58,050	64,665	65,255	.....	.....	.....	.....	.....	.....	
3.	57,765	54,765	58,305	.....	.....	.....	.....	.....	.....	.....	.....	
4.	53,930	53,410	56,265	.....	.....	.....	.....	.....	.....	.....	.....	

Lieut. F. P. Gilmore, U. S. Navy, Trans. Tech. Soc. Pacific Coast, V, p. 100, 1888.

TABLE 103.—EFFECTS OF COLD BENDING (RADIUS 8.5") AND ANNEALING. PARKER.

No.	Tensile strength, pounds per square inch.	Elastic limit, pounds per square inch.	Elongation % in 10 inches.	Contraction of area, %.	Treatment before testing.
1.	60,928	33,376	27.8	58.6	Untreated.
2.	62,160	22,400	25.7	52.6	Bent and straightened cold.
3.	69,888	29,120	20.7	50.5	Bent and straightened at a blue heat.
4.	73,248	20,160	17.6	32.0	Quenched.
5.	60,704	34,272	29.2	53.5	Bent and straightened cold four times; then annealed.

1. A plain piece of steel 1.5" x 0.76". 2. A similar piece of the same material bent cold with a radius of 8.5 inches, and then straightened. 3. The same as 2, but bent at a blue heat. 4. A similar piece heated and quenched in cold water. 5. Bent in the same way as 2, but four times instead of once; then heated to redness and allowed to cool. Parker, Journ. Iron and Steel Inst., 1887, I., p. 136.  
 a This is probably the "proportionality limit."

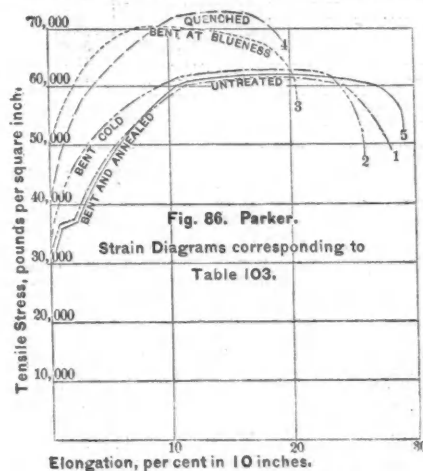
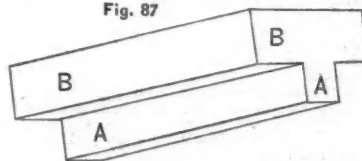


Fig. 86. Parker.

Strain Diagrams corresponding to Table 103.

The jog shown in lines 1 and 5 is very common in the strain-diagrams of wrought-iron and steel when neither hardened nor cold-worked, but not in those of other metals. A not-unusual dissimilar jog also occurs in the torsional strain-diagrams of locust and hickory wood.

Fig. 87



The effect on the modulus of elasticity is relatively slight (usually less than 5%, sometimes less than 1%), and less constant. The modulus is usually lowered slightly

<sup>c</sup> B. Baker, Trans. Am. Soc. Mech. Eng., VIII., p. 163, 1884, gives an instance in which a rotating spindle, weighted at its free end so as to cause alternate tension and compression in any given fibre, broke after 472,500 revolutions, the actual stress being only one third of the stress at transverse elastic limit. On the other hand Bauschinger concludes that 5 to 15 million repetitions of tensile stress, whose lower limit is zero and whose upper limit is near the original proportionality limit, do not cause rupture. (Mittheil aus Mech.-Tech. Lab. in München, XV., p. 37, 1886.)

TABLE 100.—INFLUENCE OF COLD WORKING ON THE PROPERTIES OF IRON.

Number.	Authority	Description	Size.			Tensile strength, pounds per square inch.			Elastic limit, pounds per square inch.			Elongation.			Reduction of area.			Increase of tensile strength, etc., by cold working, per 100 of the tensile strength, etc., before cold working.				
			Initial, inches.	Final.		Initial bar.	Hard drawn.	Annealed.	Initial bar.	Hard drawn.	Annealed.	Per centage.			Initial bar.	Hard drawn.	Annealed.	Tensile strength.	Elastic limit.	Elongation.	Contraction of area.	
				B. W. G.	Inches.							Initial bar.	Hard drawn.	Annealed.								Initial bar.
A WIRE DRAWING.																						
1 C		Wire obtainable in quantity	7 and 8	187,165	70@75,000	160,000	40,000	80,000+	15	4	12	121	100	78								
2 B		Charcoal iron wire, Bigny	14	853		102,384				0.30	15.74											
3 A		Ingot-iron wire, Firminy				127,980				0.37												
4 A		“ “ “ “				191,970				0.91												
5 A		“ “ “ “				227,592				0.75												
6 A		“ “ “ “				32,614	91,008	66.87		9.45	22.00											
7 A		“ “ “ “				68,256	89,586	61,158		7.46	0.62	22.00										
8 A		“ “ “ “				54,086	85,320	69,692		16.79	0.31	20.52	12.2±									
9 A		“ “ “ “				52,614	85,320	69,692		16.25	0.50	20.60										
10 A		Ingot-steel wire, Firminy				A127,980	B180,594	D119,472		A6.62	B3.41	14±										
		“ “ “ “				C281,786				C1.75	D8.00											
		“ “ “ “				A142,200	B191,970			A7.00	B2.95											
		“ “ “ “				C220,410	D126,583			C1.47	D6.88											
11 A		“ “ “ “				A156,420	B200,502			A6.54	B4.70	15.74										
		“ “ “ “				C234,630				C1.18		15.74										
12 A		“ “ “ “				A139,356	B216,144			A6.17	B5.67											
		“ “ “ “				C281,786				C1.36												
13 M		Open-hearth steel wire billets and square wire from them, drawn in 10 straight draughts	2	0.15 sq.	E70,000		100,000±		E30.06	1.4	10	E 50	9.2									
14 M		“ “ “ “	2	“	F86,790	178,330			F37.45	2.6		F 61.89	21.8									
15 A		“ “ “ “	2	“		181,020				1.89			35.0									
16 T		Usual properties of wrought-iron wire	1	10	60,000	90,000																
		“ “ “ “	1	15	100,000	100,000																
		“ “ “ “	1	20	111,000																	
17 A		Steel wire hard-drawn, apparently h'd'nd, and same slightly annealed	3	0.2			56,000	78,400														
18 A'		“ “ “ “	3	3	250	67,939	100,334	60,726	47,846	61,533	22.8	1.9	15.2	8	59.42	19.32	62.68	60.93	28.61	91.67	67.49	
19 A'		“ “ “ “	3	4	238	64,489	98,762	62,188	45,029	67,469	44.531	19.8	3.2	17.5	8	64.78	34.21	64.32	53.14	47.86	83.84	47.19
20 A'		“ “ “ “	3	6	208	67,782	107,722	63,750	49,078	90,070	43.702	21.7	3.5	23.6	8	66.40	45.58	66.48	58.92	83.52	88.87	81.86
21 A'		“ “ “ “	3	8	165	66,170	126,246	59,606	46,883	105,997	42.224	21.6	1.0	21.2	8	68.11	37.88	70.14	90.69	126.08	95.37	44.88
22 A'		“ “ “ “	3	10	134	66,170	122,035	67,357	46,883	85,725	49.235	21.6	0.37	22.4	8	68.11	22.05	66.17	84.43	82.82	98.29	67.63
B COLD ROLLING, ETC.																						
24 W		Pieces cut from Creusot steel and hammered cold till they were lengthened by about 7.5%			71,530	86,580	40,744	78,940		30	14	2	21	94	58							
25 B		“ “ “ “			65,184	78,384				21.5	9.7		20	60	60							
26 B		“ “ “ “			62,832	71,008				23.5	6		13	74	74							
27 B		“ “ “ “			56,000	67,200				35	10		20	71	71							
28		Norway Steel and Iron Co., compressed steel (G. H. Billings' patents)	2.03	1.936	58,000	70,000	27,000	61,000		34.6	15.6	5	42.9	33.5	27	130	55					
29		“ “ “ “	2.03	1.808	55,400	70,420	26,540	61,100		34.6	15.6	29	42.9	16.7	27	130	55					
30		“ “ “ “	2.03	1.708	55,400	81,800				35	6		42.9	16.7	27	130	55					
31		“ “ “ “	1.94	1.75	64,076	99,445	33,050	94,554		35	6		42.9	16.7	27	130	55					
32 M		Jones & Laughlin's cold-rolled iron			57,350	92,623							55	61								
33 M		“ “ “ “			49,510	66,892							49	49								
34 W		Puddled bloom			55,760	83,156	37,250	68,427					49	49								
35 W		Charcoal iron			50,927	99,293	42,439	57,396					50	106								
36 F		Cold-rolled iron, Jones & Laughlin's, Lauth's patent	1.07	1.00	52,500	69,000	21,600	30,000	33,000	20.0	7.9	10	31	67								
37 T		“ “ “ “	2.44	2.44	46,733	66,100	46,900	28,000	31,400	24.58	10.42	25.00	10	67								
38		“ “ “ “	2.06	2.06	48,500	66,938	49,500	28,200	31,800	26.25	2.75	14.25	10	67								
39		“ “ “ “	1.37	1.31	50,800	67,833	49,500	24,900	31,600	24.00	12.50	10	38	104								
40		“ “ “ “	1.06	1.06	47,400	68,167	50,900	27,700	30,367	6.90	9.50	10	35	136								
41		“ “ “ “	0.67	0.68	48,167	78,833	48,700	29,200	33,600	8.05	12.65	10	44	118								
42		“ “ “ “	2.40	2.40	96,370					19.85	4.53	15.80	10	53	119							
43		Cold-swaged steel								16.4	5		37									

1. Wire of this quality was found to be procurable in large lots for the East River Bridge. The elastic limit was always more than half the ultimate tensile strength. The "initial" bar here refer to pieces of cross-section fitted for common bridge members. F. Collingwood, Trans. Am. Soc. Civ. Eng., IX, p. 170, 1880.

2 to 13. A. Bonnaud, Rev. Univ. 24 Ser., IX., p. 323, 1881. 10 to 13 give the properties A of the wire rod, B of the hardened i. e. quenched wire (fil trempé et revenu), C of the finished wire, which has apparently undergone additional drawing after hardening; and D of the finished wire annealed.

14. Open-hearth steel wire billets, 2 inches square, made by the Otis Iron and Steel Company. The properties specified by contract, F the maximum of each of the properties in the billets tested. Rept. Chf. Ordnance, U. S. Army, 1884, p. 440. The billets were rolled into rods 0.5 inches square, annealed during 48 hours: (temperature rising to about 933° C., 1800° F., during 7 to 8 hours, then slowly cooling to about 343° C., 650° F., during about 40 hours). They were then drawn in 10 draughts without further annealing to 0.15 inches square. Idem, 1885, p. 473. Lieut. W. M. Metcalf. The details of the operations are given at great length.

15. One coil of the wire of No. 14 was lightly annealed between the 5th and 6th draughts, which reduced the tensile strength greatly, and greatly increased the reduction of area, but without increasing the elongation.

16. Usual properties of wrought-iron wire. Thurston, Mats. of Engineering, II., p. 201.

17. Slight annealing greatly raises the elastic limit of thick and apparently hardened (quenched) wire. Sir W. Armstrong, Journ. Iron and Steel Inst., 1832, II., p. 701 from paper read before Sect. G. British Ass. Aug., 1882. Thinner wire is simply softened without increase of elastic limit by annealing.

18 to 20. A two-inch billet of mild steel, carbon 0.115, silicon 0.009, phosphorus 0.072, was rolled hot to Numbers 1, 2, 4, and 5 B. W. G. respectively, and the resulting rods were drawn at a single draught to Numbers 3, 4, 6, and 8 B. W. G. The Number 8 wire was further drawn to Number 10 B. W. G. without annealing, and apparently in two additional draughts. The reduction of sectional area by wire drawing was thus 37.5, 24.7, 32.5, 46 and 66%. Horace Allen, Excerpt, Proc. Inst. Civ. Eng., XCIV, p. 1888. The density of these materials is given in Table 105.

24. Thoroughly annealed steel had the properties given under "initial": after cold-hammering on only one pair of faces it had those given under "hard drawn." Woodbridge, Birnie, Proc. U. S. Naval Inst. XIII, p. 56, 1887, from Notes on Construction of Ordnance, No. 3, Washington, July 20th, 1882.

25 to 27. Treatment of steel. Burba, Holley, pp. 51 to 54. Soft steel was hammered out cold, till its length was increased by about 7.5%. The hard-drawn results in number 25 represent the mean obtained with six bars, and their properties are compared with the mean of similar but untreated pieces. For 26-7 it is probable but not certain that the initial and hard-drawn results are from material originally of the same piece.

28. Circular of the Norway Steel and Iron Company. The steel contains about 0.14% of carbon, 0.4% of manganese, and 0.1 of silicon.

29-30. Enz and Mining JI. XXXV., p. 222, 1883. From tests on the Watertown testing machine. A single bar of hot-rolled steel was cut into three pieces. The first was tested without further treatment there given as the "initial" bar; the second after a single draught, which reduced its diameter from 2.03 to 1.936 inches; the third also after a single but more severe draught, which reduced its diameter from 2.03 to 1.808 inches. The modulus of elasticity of the uncompressed bar was 29,000,000; that of the first of the two compressed (hard-drawn) bars was 31,000,000. In compressive tests, the permanent set and the compression was almost exactly the same in the compressed as in the uncompressed steel.

31. G. H. Billings, private communication, May 9th, 1888. The initial and the hard-drawn pieces are from the same bar. The initial was turned down to 1-inch diameter in a lathe before testing. Modulus of elasticity of the uncompressed (initial) bar 29,400,000; of the compressed (hard drawn) 36,400,000.

32-33. Tests by Merrick & Sons, Southwark Fdry. Thurston, Rept. on Cold-rolled Iron, 1887, p. 12.

34-35. W. Wade, 1860: Idem, p. 10.

36. Wm. Fairbairn, Rankine, Civil Engineering, 1870, p. XVI. Also Thurston, Op. Cit. p. 7.

37-42. Thurston, Op. Cit., pp. 82-3, 109. In Nos. 33 to 42 the "initial" and the "cold-rolled" results each represent three bars. The cold-rolled pieces were from the same bars as the "initial" or hot-rolled ones. All were tested as they came from the rolls, without subsequent reduction in the lathe.

43. Mild-steel cold-swaged at Washington Navy Yard. The elongation was 3% on 30 inches, and 16.4% on the 5 inches where rupture occurred. Rept. Tests on Strength of Struct. Matl. Watertown Arsenal, 1883, p. 178.

but is sometimes raised by cold-stretching and cold-hammering: (e. g., table 101, VI., 3; VII., 2; I., 8; and II., 8). During rest after stretching in Bauschinger's experiments it seems usually to undergo a change opposite in sign to that noted immediately or shortly after stretching or cold-hammering, and greater in amount, and so returns past and to a point slightly above or slightly below its original value as the case may be (e. g.,

table 101, line 6, cases I., II., III., IV., VI.; line 23, cases IX., X., XI.; line 9, cases I., II.; exceptions, line 6, cases V., VII). But this can hardly be put forth confidently.

(TO BE CONTINUED.)

NOTE.—The publishers of the ENGINEERING AND MINING JOURNAL will thank the readers of this article if they will promptly call attention to any inaccuracies they may observe in it.

## PERSONAL.

Messrs. Howard Oviatt and M. C. Hillyer have returned from their visit to the Victoria mine, in Summit County, Colo., in which both gentlemen are interested.

Prof. C. Wellman Parks, professor of physics at the Troy Polytechnic Institute, Troy, N. Y., who is in charge of group No. 2 of American exhibits at the Paris Exposition, sailed for France on the 16th inst.

Mr. E. B. Kirby, the recent superintendent of the Philadelphia Smelting and Refining Company, of Pueblo, Colo., has not been appointed assistant general manager of the works, as reported in our issue of the 2d inst.

Mr. Carl Henrich, mining engineer and metallurgist, is about to start for New Mexico and Arizona on professional business. He will be away for several weeks, and on his return will open an office as consulting mining engineer, probably in St. Louis.

The Hon. Abram S. Hewitt and Edward Cooper, of New York, are now traveling through the South investigating the coal and iron resources. They have been in Tennessee and will go through Alabama and probably to Florida before they return home.

Mr. J. B. Haggin, of the Anaconda Company, of Montana, and the representative of the Calumet & Hecla Mining Company, sailed on the 16th inst. for England, to meet the representatives of the European copper interests, with a view of repairing the much damaged syndicate.

Captain Morcom, an old Lake Superior miner, and for several years connected with the mines of the Menominee Iron Company, Michigan, and later for a few years with the Minnesota Iron Company, Minn., will shortly go to Cuba to take charge of some iron mines there.

Mr. M. E. Wadsworth, of the Michigan Mining School, has been appointed State Geologist of Michigan for two years, from May 1st. He is now holding the position by appointment to fill out the vacancy caused by the death of Mr. Charles E. Wright. It is reported that the Board has decided to publish another volume of the Report of the Survey, covering the works of Rossinger, Wright and Wadsworth.

Mr. Azel B. Hull, a well-known mining official, died in Oakland, Cal., on the 14th inst. He was about 79 years of age, and a native of New York. Mr. Hull went to the Pacific Coast in 1876. Since then he has been a Director and Vice-President of the Consolidated Virginia, California, Gould & Curry, Best & Becher, Sierra Nevada, and other prominent corporations, and was Vice-President of the Consolidated California & Virginia Company at the time of his death.

The Secretary of the American Institute of Mining Engineers has issued the following circular:

"In accordance with a cordial invitation received through the President of the Institute, it is proposed to hold the next meeting in Colorado, in June. The plan includes sessions at Denver, Manitou and Pueblo, and also an excursion to the important mining district of Aspen and the coal-field at Glenwood Springs. The meeting and excursions together would occupy something more than a week, arrangements being so made as not to require a Sunday travel.

"The Council, before accepting this invitation, desires to know how many members would probably be able to attend such a meeting. In view of the fact that a certain number of members intend to visit Europe this summer, it is deemed advisable to make this preliminary inquiry.

## INDUSTRIAL NOTES.

The puddlers of the Maiden Creek Iron Company, at Blandon, Pa., have accepted a reduction in wages from \$3.50 to \$3.25 per ton. The wages of all other employes have been reduced in proportion.

Mr. C. H. Emerson has been appointed receiver of the Findlay Iron and Steel Company, of Findlay, Ohio. This is said to be due to financial complications contracted before the removal of the plant from Cincinnati. The liabilities are said to be \$30,000.

The Bellefonte Nail Works at Bellefonte, Pa., resumed work in all departments on the 12th inst., with a full force, after an idleness ranging in the different departments from one to three weeks. The Center Iron Company's rolling mill also resumed after five weeks' idleness.

The battery of boilers of the West Point Boiler Works, owned by Monroe & Sons, at Pittsburg, Pa., exploded on the 14th inst., and brought destruction to everything in the neighborhood, killing several men. The boiler had been inspected recently. The cause of the explosion is not known.

Following the iron manufacturers in the Schuylkill Valley and points near Philadelphia, firms throughout Lebanon Valley, Pa., have reduced their puddlers 25 cents per ton and other employes in proportion. At Light's rolling mill, at Lebanon, the puddlers have accepted a reduction from \$3.75 to \$3.50 per ton and employes at other places are holding the matter under advisement.

The Scott foundry rolling mill, the new pipe mill and the forge of the Reading Iron Works, at Reading, Pa., suspended operations on the 11th inst., and will probably not resume until the company's affairs, to which we referred in our last issue, are settled. The sheet mill has been closed for some time, and the company's

only works in operation are the blast-furnaces and a portion of the tube mill.

The Sturtevant Mill Company, Limited, has been organized in London, with a capital of £12,000, in £10 shares. The object is to acquire by purchase, license, or otherwise, and either absolutely or conditionally, and either wholly or partly for cash or shares, stocks, bonds, or other securities of the company, the inventions of Thomas Sturtevant relating to attrition mills, and the letters patent for the same for the United Kingdom.

The Ingersoll Rock-Drill Company and the Sergeant Drill Company, of New York, have been consolidated into a new company, known as the "Ingersoll-Sergeant Rock-Drill Company." The company will continue the manufacture and sale of the machinery so well known under the names "Ingersoll" and "Sergeant," with many improvements and additions, which have been effected through the consolidation of interests.

The new company is the sole manufacturer and proprietor of the following machines: Ingersoll tappet drill, Ingersoll eclipse drill, Sergeant drill (both tappet and auxiliary valve), Ingersoll-Sergeant air compressor, Ingersoll stone channeling machine (rack and bar channeler), Ingersoll standard gagger, Ingersoll-Sergeant quarry bar, Sergeant coal mining machine, and will furnish, furthermore, the standard Bullock diamond core prospecting drills, and a general line of mining, tunneling and quarrying machinery.

The last of the pipe mills of the Reading Iron Works, Reading, Pa., closed down on the 13th inst., and now all the vast establishments of the firm, to the difficulties of which we referred in our last issue, are out of operation excepting the two blast furnaces, which have about a week's stock of coal on hand. The workmen, to whom 15 days' wages are due, have received notice that on the 16th inst. next they would receive one week's pay.

On Thursday the creditors held a meeting in Philadelphia, at which a statement was submitted showing total liabilities \$1,875,959.91, instead of \$1,927,783.22. This amount includes a bonded debt of \$600,000; bills payable, \$630,730.69; open accounts due by the company, \$177,919.25; open accounts due warehouse, \$26,819.14; loans, \$151,427.76; indorsements on bills receivable, received, or unfilled orders, \$271,324; wages unpaid, \$17,000; bills receivable, discounted, on which the company are liable, \$942,285.18. The assets are valued at \$2,091,747.24. A committee of five consisting of George De B. Keim, Comley B. Shoemaker, John H. Craig, Samuel R. Seyfert and W. C. Frick, was appointed to draft a plan of reorganization, to be submitted to the creditors at a meeting to be called for next Thursday.

Mr. Baer submitted the following plan of reorganization: Start up the works as speedily as possible, each department to be run separately, and if one or more do not pay, close them; dispose of the surplus real estate, including the Lehigh Avenue property in Philadelphia, which, it is believed, will net the company at least \$200,000, the receipts of the sale to be applied to the sinking fund of the first mortgage; the main office of the company to be removed to Reading, and the duplicate and triplicate system of bookkeeping dispensed with, thereby doing away with a large number of clerks; a warehouse will be maintained only in Philadelphia. The reorganization scheme suggested by Mr. Baer met with the approval of the creditors present. It is stated that Mr. Baer will be elected president under the reorganization in place of E. W. Colt, of Philadelphia.

## CONTRACTING NOTES.

Our list of machinery and supplies wanted will be found on page xii. Manufacturers of machinery, engineers and contractors should also consult our directory of "Contracts Open" on the same page. This week, proposals are invited for the following new contracts: No. 1325, Constructing Tunnel; No. 1326, Constructing District Tunnel Sewers; No. 1327, Constructing New Masonry Lock; No. 1328, Dredging; No. 1329, Building Dry Dock; No. 1330, Furnishing Iron and Brass Castings; No. 1331, Constructing Masonry Aqueduct.

The Gas Commission of New York has advertised for bids to light the streets for the year beginning May 1st next. The appropriation is no larger than last year's, and it is said that if the electric light companies undertake to raise their prices in districts where there is no competition, the Commission will return to the use of gas.

The Delaware & Lackawanna Railroad Company has contracted with the Excelsior Iron Works Company, of Cleveland, Ohio, for a complete plant of Thornberg patent derricks, six in number. They will be put in at the foot of Erie street, Buffalo, N. Y., and will be used for transferring iron ore from vessels to cars. The work will be finished by May 1st.

## GENERAL MINING NEWS.

At the adjourned meeting of the Miners' National Union, jointly with the operators, at Columbus, Ohio, which began on the 13th inst., the Indiana coal miner delegates, unable to agree with others of the convention on a scale of prices, withdrew. A committee of operators and miners was appointed to make a scale for Pennsylvania and Ohio. The miners want a renewal of that of last year, but the operators are holding out for reduced rates per ton. The Indiana operators

insisted on a 12 per cent reduction from the present yearly mining scale, which expires May 1. The scale was fixed in 1887, and a discrimination existed in favor of Ohio and Pennsylvania because of their natural gas. Since then Indiana has become a gas State. Furthermore, Ohio and Pennsylvania operators, driven from their home market by gas and aided by lake transportation, it is stated, have succeeded in capturing from Indiana operators their principal markets in the Northwest. As a result its mines have been working on one third time for several months.

## ALABAMA.

ALABAMA COAL, IRON, LAND AND COLONIZATION COMPANY, LIMITED.—Notice is given that seven installment coupons of 10s. each (Nos. 11 to 17 inclusive) upon each of the installment certificates of this company, issued in exchange for Alabama 8 per cent gold State bonds of 1870, will be payable at the company's offices, 19 King's Arms-yard, Moorgate-street, London, on and after the 5th March.

FORT PAYNE COAL AND IRON COMPANY.—This company, to the organization of which we referred in our issue of November 24th, 1888, is now being floated mostly in the East. The company has a large capital but has not yet shown any ground for the expectation that it will ever pay dividends. Its coal and iron ore are of very inferior quality and are not in quantity to compensate. Proposing investors will do well to investigate the economic conditions and not assume that, because some well-known and eminently respectable gentlemen, who are not experts, are associated with the enterprise it must necessarily be good. It is not difficult to ascertain the "bottom facts" in the case.

## ALASKA.

ALASKA MINING AND EXPLORATION COMPANY, LIMITED.—This company has been organized in London with a capital of £200,000 in £1 shares. The object is to acquire by purchase, lease, license, or otherwise, any lands, mineral properties and rights appertaining to the prospecting for minerals. The directors are Samuel Baylis, Robert Maitland Brereton, Charles Challoner Smith and Frederick Peterson Ward; and the consulting engineer is John Darlington, M. E. The directors, as remuneration, shall be paid £1000 per annum.

A provisional contract has been made on behalf of this company for the purchase of two thirds of the shares in the Mexican Gold and Silver Mining Company, the owners of the Mexican mine, Douglas Island, the consideration being the sum of £100,000 in cash and £15,000 in fully-paid shares. The Mexican mine is now owned by the Mexican Gold and Silver Mining Company, of San Francisco, which was incorporated in 1885 under the laws of the State of California. Its stock consists of 100,000 shares of the nominal value of \$100 each. These shares are held by three American citizens, each of whom holds a third. The company will acquire the interests of two of these gentlemen. The remaining one third interest is owned by a well-known capitalist of San Francisco and New York, who does not wish to sell, and who provides one-third of the working capital required for the development of the property. The Mexican mine adjoins, and is on the same ledge as the Paris mine. It contains four full mining claims, giving a total length of 3000 feet along the strike or course of reef, and a total width of 1200 feet, together with four mill sites along the shore of the Gastineaux channel. The cost of erecting a large reduction mill, machinery and buildings, and of opening up the reef for supplying the mill with quartz is estimated at £75,000, of which this company is to find £50,000. The works will, it is expected, be in full operation by the end of this year. The property has been reported upon by Mr. I. B. Hammond, M. E. (who has personally examined the property), and to Mr. R. M. Brereton's general statements about the Douglas Island ledge (which he has recently examined.) From these reports it appears that in the opinion of these gentlemen the ore proved, and actually in sight, is of the net value of £375,000, and that within three years of starting the stamps, the whole of the purchase money and working capital should be returned in dividends.

## ARIZONA.

## GRAHAM COUNTY.

GOLD MOUNTAIN GOLD AND SILVER MINING AND REDUCTION COMPANY.—This company has been organized with a capital stock of \$500,000; shares \$1 each, non-assessable. The principal place of business will be at Clifton, in Clinton, Missouri. This company will operate mining property in Graham and other counties and erect works for the reduction of the ores, and do a general mining and milling business. The incorporators are Peter E. Kern, of E. Paso; Marshall P. Wright, John E. Gano, Ephraim Allison, Frank S. Ware, Chas. W. Jordan, Wm. J. Elliston, Wm. D. Tyler and Wm. H. Allison, of Missouri.

## PIMA COUNTY.

PHOENIX MINING COMPANY.—Reports from Tucson state that there is a good prospect of the Phoenix mine being opened up by New York men, who have been examining it, and are expected back by March 20th. In our last issue we referred to the settlement of the company's financial difficulties.

## COLORADO.

A bill has been passed by the Legislature modifying the incorporation laws of Colorado. Heretofore the minimum value of a share of stock was fixed at \$10, and a company desiring a great number of shares was compelled to place its capitalization at an enormous figure. Now, or as soon as the enactment becomes a law, a company can be incorporated and make the face value of its shares \$1, \$2, \$5, \$10, or any other number of dollars. The capital stock of a company can thus be divided up into \$100,000

shares, without raising the capitalization to \$1,000,000, as has been necessary under the old law, which limits the value of shares to \$10. One of the greatest objections and injuries to Colorado mining has been the excessively high capitalization of companies, and this modification is expected to obviate all excuse for million-dollar corporations founded on a \$10,000 basis. The bill was introduced by Senator Samuel Adams, of Leadville, who has had a great deal of experience in the working of mines and the operation of stock markets.

Work has begun upon the Bessemer and Huerfano irrigating canal at Pueblo. This is the Colorado Coal and Iron Company's canal, which takes its water from the Arkansas River at a point 14 miles west of Pueblo and runs across the table lands just west of Pueblo, and will empty into the Huerfano 30 miles southwest. The ditch will be 22 feet wide in the bottom, seven and a half feet deep and 26 feet wide on top. It will open to cultivation 125,000 acres of agricultural land in the Arkansas valley. Messrs. Orman & Crook, railroad contractors, have been awarded the contract for building the canal.

Messrs. A. A. Beard and Jerre Irwin, proprietors of the lime quarries at Frying Pan, are now making excavations for a number of lime kilns. The product of the quarries average 98 per cent. Large quantities are being shipped to Leadville, and there is talk of shipping to the Pueblo and Denver smelters.

**I. X. L. MINING COMPANY.**—The meeting held in St. Louis last week for the purpose of raising money to increase the working force was in every way successful, and the \$2,500 required was subscribed by those present, who expressed a willingness to contribute as much more should it be required.

#### CLEAR CREEK COUNTY.

[From our Special Correspondent.]

C. E. Dewey is enlarging the capacity of his mill and putting it in good repair for the coming season. Messrs. Woodard and Hartzell are adding a set of rolls to their mills.

**ARGO.**—This mine, which has been shut down for some time, is now being pumped out preparatory to beginning work.

**FLORENCE MINING AND MILLING COMPANY.**—This company, at Georgetown, is pushing its tunnel ahead rapidly. It is also preparing to start the concentrating mill as soon as the weather will permit.

**KOHINOOR AND DONALDSON MINING COMPANY.**—The mill was started about the 10th inst. on ore from the Champion mine. This mine is located on the summit of Bellevue Mountain, some 6000 feet from the mill, the ore being brought down by a wire tramway, at a cost of 25c. per ton.

#### GARFIELD COUNTY.

**GRAND RIVER COKE AND COAL COMPANY.**—The output of this company's mines is as follows: New Castle mines, 12 cars per day; Marion mine, Jerome Park, 12 cars per day; Soring Gulch mine, Jerome Park, 8 cars per day; Sunshine mine, Jerome Park, 7 cars per day; total, 39 cars, or 780 tons, daily.

#### GILPIN COUNTY.

**ROLLINS GOLD AND SILVER MINING COMPANY.**—The option held on this property by J. P. Hopkins of San Francisco expired on the 1st inst and as nothing has been heard from Mr. Hopkins the officers of the company in New York presume that he has been unsuccessful in his endeavors to enlist sufficient capital to purchase the mine and accordingly the matter will be dropped for the present. Whether anything further will be done to rescue the company from its present unenviable condition to which we referred in our issue of January 12th, Mr. Addison T. Andrews, the secretary of the company, is unable to say.

#### GUNNISON COUNTY.

The Plata Rico and Ida May mines, gold bearing, located in Dutch Gulch, above Ohio City, have been sold to D. W. Gunn, of Sterling, it is stated, for \$18,000. The properties promise with development to become heavy and rich producers. The present development comprises an adit of 355 feet, main shaft 70 feet and two winzes of 20 feet each. Some stopping had been done by the late owners and good ore shipped.

#### LAKE COUNTY.

**IRON HILL CONSOLIDATED MINING COMPANY.**—The property of this company was sold last week at trustee's sale by John L. McNeil, the trustee, for \$70,000. The creditors purchased the property, and as the stockholders have six months in which to redeem, it is not known whether there will be a reorganization until after expiration of that time or not. The property consists of the White Cap and other claims on the hill, near the Silver Cord and Smuggler.

**LITTLE PITTSBURG CONSOLIDATED MINING COMPANY.**—From a circuit just issued, we learn that the time for the redemption of this company's property, now held by its judgment creditors, the Little Chief Mining Company, expired on February 25th, and has been extended to May 25th, as we already mentioned in previous issue of the ENGINEERING AND MINING JOURNAL. The stockholders, failing to assent to the proposition of an assessment of twelve cents per share to liquidate the indebtedness, it has been proposed to organize a new company under the laws of New York, with an authorized capital stock of \$100,000; shares, twenty-five cents each. Stockholders of the old company to have the privilege of taking one share of such new stock for each share of old stock held by them respectively, upon paying therefor twenty-five cents per share, and surrendering their old stock, which will be held for the benefit of the new company; and to have the further privilege of taking such additions

stock of the new company at par as they desire. In the event that applications are received for more than the whole of such new stock, the same will be allotted proportionately. The money realized from such new stock will be used to perfect title to the property in the new company and to furnish a working capital. The receipts for payments made for such new stock will be issued, to be held until the new stock is ready for delivery, or until it is demonstrated that this plan will not succeed as hereinafter provided. Any of said new stock not disposed of as above contemplated will be disposed of, if possible, at such price, not less than twenty-five cents per share. The right is reserved to return to stockholders assenting to this plan their old stock and the amount paid in by them respectively, less five per cent thereof for expenses, and to cancel such applications, if sufficient funds are not obtained under the provisions hereof to redeem the property. The time for subscribing to the stock will expire March 25th.

**MIKE AND STARR.**—A copper strike was made in this mine last week. Ore taken from the heart in the southeast drift assayed, it is said, 60 ounces silver and 14 per cent copper. Shipments from the mine have been increased to 40 tons a day.

#### OURAY COUNTY.

**FLORENCE MINING AND MILLING COMPANY.**—This company, of Ouray, has purchased the Needles mine on the gold belt of Gillespie & Co., it is said for \$25,000.

#### PITKIN COUNTY.

**W. R. Rust, of the Rust Sampling Works, at Aspen,** has brought a suit against this company for \$49,450 damages. The suit is based on a contract set up by the plaintiff, under which Mr. Rust was to handle all of the company's ore for one year from November 1st, 1888. There was to be no charge for sampling. The plaintiff leased the Hewitt works for the purpose, and fitted them up at a total expense of \$5300. He sets up that he had arrangements for disposing of the ore by which he would have made \$1.50 per ton on it. It is claimed that in January the company stopped delivering ore to the plaintiff. He sues for his expenses, for \$1.50 a ton on 5100 tons of ore diverted from him up to March 1st, and for \$1.50 per ton on 24,000 tons that it is estimated will be mined and shipped from March 1st to November 1st. What the defense will be has not yet developed. Mr. J. B. Wheeler, the President of the company, however, stated to an ENGINEERING AND MINING JOURNAL reporter this week, that the suit was of little importance. The contract with Mr. Rust, Mr. Wheeler said, was simply a verbal agreement that Rust could sample the ore if he could do it as cheaply as any one else. Mr. Rust's work failing to give satisfaction, the company simply refused to deliver any more ore.

#### IDAHO.

##### BOISE COUNTY.

The Elkhorn, Gladstone, Orofino and Revenue gold mines on Elk Creek, near Idaho City, were recently examined and bonded by Capt. Smart for Boston capitalists. The stipulated price, \$12,000, has been paid over by the Boise County Bank. The company has 30 days yet in which to pay for the Elkhorn at the bonded price, \$30,000.

#### MICHIGAN.

**ROPES GOLD AND SILVER MINING COMPANY.**—At the annual meeting held at Ishpeming on the 11th inst., Julius Ropes was elected President; Clarence Riley, secretary; E. P. Howard, Treasurer, and George Weatherstone, Superintendent. The company is now reported out of debt, has a surplus in the treasury, and has good mill equipments. The production of gold and silver was over \$100,000 for the past twelve months.

#### COPPER MINES.

**CONGLOMERATE MINING COMPANY.**—The property of this company will be sold at Eagle River on the 15th of April. Much money has been spent on the mine. The stamp mill at Lac la Belle, which is connected with the mine by a well-equipped railroad, is stated to be one of the best in the State. Since the opening of the mine, it has produced 3,700 tons of copper. The Conglomerate Mining Company took possession of the property in 1881, and for three years worked on what is known as the Allouez conglomerate, and which in 1884 was found to yield 9½ pounds of copper to a ton of rock treated at the mill, but which with the then price of copper would not pay to work.

#### MONTANA.

##### DEER LODGE COUNTY.

**GRANITE MOUNTAIN MINING COMPANY.**—The new 90-stamp mill at Rumsey was to begin operations on the 10th inst.

##### LEWIS & CLARKE COUNTY.

**MONTANA COMPANY, LIMITED.**—Official reports of the Secretary show that total weight of ore crushed during February was 6134 tons; yield from the three mills, \$108,300; working expenses for the month, \$49,500. The tonnage of ore crushed is small, owing to February being a short month.

##### SILVER BOW COUNTY.

**ANACONDA COMPANY.**—The company suffered serious loss by the burning of its new smelting works at Anaconda on the 14th inst. The direct loss to the company in buildings and machinery will be large. The latest advices say: One of the smelters of the Anaconda Mining Company, at Anaconda, burned yesterday. The fire was first discovered in the middle of the roof of the ore-houses at the lower works. An attempt was made to save the adjoining buildings. In this the firemen were partially successful. The concentrator and stamp-mill are in the same building as the ore-house, and they were saved. The great smelter

building lies just north of the ore-house, where the fire caught, and contained twenty of the Brueckner furnaces. Within two hours after the outbreak of the fire this great building was entirely destroyed, and not a stick in its whole forest of framework was left standing. The wreck was total. The flames then spread to the new building, 400 feet square, which was being erected for calcining furnaces, and this was also consumed. At least one half of the plant was destroyed, and what is left is rendered useless altogether until the rest can be rebuilt. The buildings were all new, as was also the machinery, which was heavy and expensive. There is little doubt that the fire was of incendiary origin.

**BOSTON & MONTANA CONSOLIDATED COPPER AND SILVER MINING COMPANY.**—The official returns of this company show product of refined copper produced for the year 1888 to be 18,115,333 pounds, and 21,878 ounces of silver. The treasurer adds: "We did not begin to produce silver till August, 1888, and then only in a small way, but the prospect is that this year our silver product will be materially increased, our product of that metal for the single month of January, 1889, being 14,687 ounces."

#### NEVADA.

##### ESMERALDA COUNTY.

**PAMLICO.**—A suit against this mine, Hawthorne district, was to begin in the United States Court at Carson on the 11th inst.

##### STOREY COUNTY—COMSTOCK LODE.

We condense the following from the Virginia City Chronicle:

The sums disbursed to employees of Comstock mining companies for services during February, amounted to \$214,862. The above is merely the sum disbursed in wages to employees, and does not include other operating expenses. Of the total disbursed the Consolidated California & Virginia office paid out \$48,964.

**CONFIDENCE MINING COMPANY.**—This company has received a total of \$48,709.33 thus far on February account, with a large clean-up to come. A portion of the bullion in these shipments belongs to the Challenge Mining Company.

**HALE & NORCROSS MINING COMPANY.**—The bullion production for February amounted to \$68,500.

**OCCIDENTAL MINING COMPANY.**—A run of 100 tons of Occidental ore at the Alta Mill, by the double process of concentrating and amalgamating the pulp, resulted in a saving of 76 per cent of the assay value. By more careful amalgamation it is anticipated that 82 per cent of the assay value of the ore can be saved by the double process.

**OVERMAN MINING COMPANY.**—This company has received a bullion shipment valued at \$9171.16, being the product of the mine for February.

**SAVAGE MINING COMPANY.**—The bullion production for February amounted to \$27,878.

#### NEW MEXICO.

##### GRANT COUNTY.

**AZTEC MINING COMPANY.**—The mill of this company has been under consideration for some time, and will be ordered at once. The Bremen mill, which has been operated by this company under lease for three months, has closed.

#### OHIO.

The Executive Committee of the Ohio District of the Progressive Union of Miners held a meeting at Columbus on the 14th inst. to consider the question of screens at Salineville, in the Hocking Valley district, where they are not regular in size. The operators appeared and stated that they would not remove the screens as requested, and it is said that the Executive Committee will declare a strike there at once. This may be the beginning of a series of strikes in the valley.

#### PENNSYLVANIA.

##### COAL.

**CLEARFIELD CONSOLIDATED COAL COMPANY.**—A second meeting of the stockholders of this company was held on the 12th inst., in pursuance of the orders of the Court of Common Pleas. The conflict between rival Boards was ended by the buying out of one party's holdings. A new Board was elected consisting of Edward C. Lee, Kenton Warne, J. K. Levan, William P. Davis, and Samuel P. Langdon. The Board subsequently elected Samuel P. Langdon President, and J. L. Lee, Secretary and Treasurer. In our issue of the 5th inst., we referred to the difficulties of the company.

##### NATURAL GAS.

**CHARTIERS NATURAL GAS COMPANY.**—It is stated that Drexel, Morgan & Co. have contracted to take seven tenths of \$1,000,000 bonds to be issued by this company, and the remainder, if it is necessary to do so, will be purchased by members of the Charters Company.

##### OIL.

Quite an oil excitement has sprung up at East Titusville, the home of the wells of old, and every foot of land within a mile of the little settlement has been gobbled by speculators. The oil men hope to find the lost end of the oil belt which produced the 1,000 barrels of former days.

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 February, 1889, and during the eight months ended February 28th, 1889, as compared with similar exports during the corresponding periods of the preceding, as follows: February, 1889, \$3,505,479; February, 1888, \$3,663,388; eight months ending February 28th, 1889, \$42,466,963; eight months ending February 29th, 1888, \$41,577,858. It is stated on good authority that the distilla

tion of 100 gallons of crude petroleum will yield 76 gallons of illuminating oil, 12 gallons of gasoline, benzine or naphtha, 8 gallons of lubricating oil, and 9 gallons of residuum.

**UTAH.**

**DICKERT & MYERS SULPHUR COMPANY.**—This company has been shut down during the present litigation, and will not resume operations until the suits are settled. Mr. Dickert says it would take seventy-six cars of sulphur to fill his orders; but not a thing can be done now. The case came up in February on the exceptions before a full bench, but no decision has yet been rendered. The present suit refers to three of the company's claims, which have been worked so far; the company owns about twenty-two claims. At the present it would be too expensive to begin development work on these claims.

**SUMMIT COUNTY.**

**DALY MINING COMPANY.**—During February the company produced 17,290.51 fine ounces of silver and sold ore valued at \$18,497.38.

**ONTARIO SILVER MINING COMPANY.**—During February the company produced 79,865.99 fine ounces of silver and sold ore valued at \$22,216.07.

**FOREIGN MINING NEWS.**

**CANADA.**

**PROVINCE OF NOVA SCOTIA.**

**DUFFERIN.**—We are officially advised by telegraph that this gold mine was sold at public auction, at Halifax, on the 14th inst., to Mr. Archibald, for \$141,000. This mine is situated on the Atlantic Coast, about ninety miles east of Halifax. The mine embraces about 342 acres, each 150 x 250 feet, all in one block. The leases have nearly fourteen years to run, and can at any time be renewed for a period of twenty-one years, upon payment of two dollars per acre.

**PROVINCE OF ONTARIO.**

It is reported that American capitalists are organizing a syndicate to convey gas to Detroit from the gas well recently discovered at Kingsville.

**MEXICO.**

**LOWER CALIFORNIA.**

The excitement in the Santa Clara district about the recent gold discoveries continues. We learn from a reliable correspondent that there is no question about the existence of more or less good placer ground there, but to what depth it goes or exactly what area it covers, or how long it may hold out, it is at present impossible to say. Our correspondent writes:

"The streets of San Diego remind one of an old time excitement, and the surrounding country here is being considerably depopulated daily, to the detriment of business. Men are going in crowds by regular steamers and chartered schooners to Ensenada, and also by rail and otherwise to Tia Juana, and thence overland, and there are, undoubtedly, many more on the road now than authentic reports warrant in going and than can take care of themselves after they get there, to say nothing of the hundreds that will go within the next ten days. The total quantity of gold shipped thus far has been comparatively small, and mostly obtained by Mexicans. As some of it has been sent to Mazatlan it is hard to figure a fair total production."

We have received a map of the district, which we shall publish next week.

**MEETINGS.**

**Acadia Coal Company, Lr.,** No. 1 Broadway, New York City, March 17th, at twelve o'clock, noon. Philip P. Harris, secretary.

**Delaware Coal Company,** 227 South Fourth street, Philadelphia, Pa., March 20th, at twelve o'clock noon.

**Manhattan Oil Company,** 51 Front street, New York City, March 20th, at one o'clock P. M.

**Merchants and Miners' Transportation Company,** 214 Water street, Baltimore, Md., March 20th, at twelve o'clock noon.

**Midland Mining Company,** 234 South Fourth street, Philadelphia, Pa., March 19th, at twelve o'clock noon.

**Rockville Iron and Coal Company,** 320 Walnut street, Philadelphia, Pa., March 19th, at half-past eleven o'clock A. M.

**Tennessee Coal, Iron and Railroad Company,** Tracy City, Grundy County, Tennessee, April 1st, at twelve o'clock, noon. James Bowron, secretary.

**The Baltimore Gold and Silver Mining and Smelting Company,** 1b. masville, Davidson County, N. C., March 18th, 1889, at one o'clock P. M. General meeting for the purpose of determining what measures shall be adopted to relieve the company from debt, whether money shall be raised to develop the company's property, whether the company shall be reorganized or the charter amended, for providing for the amendment of the by-laws. D. K. E. Fisher, President.

**DIVIDENDS.**

The following dividends have been declared: **Aspen Mining and Smelting Company,** of Colorado, dividend No. 5, of twenty cents per share, or \$40,000, payable March 15th, at No. 54 Wall street, New York City.

**Barclay Coal Company,** of Pennsylvania, seventy-five cents per share, payable March 20th.

**Idaho Gold Mining Company,** of California, dividend No. 283, five dollars per share, or \$15,500, payable March 10th.

**Iron Silver Mining Company,** of Colorado, dividend No. 25, twenty cents per share, or \$100,000, payable April 2d, at No. 23 Broad street, New York City.

**Philadelphia (Natural Gas) Company,** dividend No. 41, one per cent, payable March 15th, in Pittsburg, Pa.

**Tamarack Mining Company,** of Michigan, dividend No. 5, five dollars per share, or \$200,000, payable April 1st, in Boston.

**ASSESSMENTS.**

COMPANY.	No.	When levied.	D'ty in office.	Day of Sale.	Am't per share.
Anchor, Utah.....	10	Feb. 1	Mar. 3	Mar. 25	.10
Anna, Dak.....	3	Feb. 11	Mar. 18	Apr. 10	.062½
Baltimore, Nev.....	4	Feb. 4	Mar. 8	Mar. 26	.25
Belcher, Nev.....	37	Feb. 19	Mar. 25	Apr. 12	.50
Big Hole Placer, Utah.....		Feb. 25	Apr. 8	May 6	.005
Bullion, Dak.....	6	Jan. 4	*Mar. 8	*Mar. 25	.005
Con. Pacific, Cal.....	10	Feb. 5	Mar. 11	Apr. 2	.15
Crocker, Ariz.....	6	Feb. 25	Apr. 2	Apr. 24	.10
Deadwood Red, Dak	1	Feb. 23	Mar. 26	Apr. 13	1.00
December, Utah.....		Feb. 11	Mar. 25	Apr. 15	.02
Golden Prize, Nev.....	1	Feb. 16	Mar. 20	Apr. 10	.30
Goodman, Nev.....	5	Jan. 15	Feb. 16	Mar. 20	.25
Gray Eagle, Nev.....	11	Jan. 23	Feb. 26	Apr. 5	.03
Haywood, Dak.....		Jan. 21	Feb. 23	Mar. 19	\$1.60
Hector, Cal.....	1	Jan. 29	Mar. 14	Apr. 15	.15
Julia, Nev.....	23	Jan. 30	Mar. 7	Mar. 28	.10
Lapanta, Nev.....	1	Feb. 28	Apr. 5	Apr. 26	0.3
Martin White, Nev.....	22	Jan. 19	Mar. 6	Mar. 26	.25
Mexican, Nev.....	37	Mar. 5			.25
Mono, Cal.....	27	Feb. 28	Apr. 2	May 8	.50
Mount Terry, Dak.....	1	Jan. 30	Mar. 4	Mar. 20	.001½
North Peer, Cal.....	5	Feb. 25	Apr. 1	Apr. 24	.05
Peer, Ariz.....	7	Jan. 28	Mar. 5	Mar. 28	.10
Piedmont, Nev.....	1	Jan. 28	Mar. 6	Mar. 27	.05
Pilgrim, Mich.....		Dec. 31	Feb. 1		.50
San Luis, Cal.....	22	Jan. 30	Mar. 2	Mar. 19	.00144
Scott Bar, Cal.....	2	Jan. 23	Feb. 26	Mar. 19	.10
Sierra Nevada, Nev.....	94	Mar. 5	Apr. 9	Apr. 29	.25
Utah, Nev.....	6	Mar. 5	Apr. 10	Apr. 29	.25
Spanish R., Dak.....	2	Jan. 30	Mar. 5	Mar. 20	.02
St. Louis, Cal.....	2	Jan. 14	Feb. 8	Mar. 11	.05
Western, Cal.....	2	Feb. 21	Mar. 26	Apr. 16	\$2.00

\* Delinquent day and day of sale postponed to dates given above.  
† An additional .005c. a share is payable May 6th, delinquent May 8th and saleable June 10th.

**MINING STOCKS.**

**New York.**

Friday Evening, March 15.

The mining market still continues in an uninteresting, unprofitable, and inanimate condition. Transactions for the week have been unusually light. On the Consolidated Stock and Petroleum Exchange, business has been as follows: Saturday, 23,250 shares, Monday, 10,450 shares, Tuesday, 11,200 shares, Wednesday, 6,475 shares, Thursday, 17,000 shares, and to-day, about 12,000 shares.

Rappahannock shows a small business at 8c. Phoenix of Arkansas is quoted at 11c.

We understand that the application of the Silver King Mining Company, of Michigan, to have its stock listed on the Consolidated Stock and Petroleum Exchange has been rejected, and it is said that this refusal has prevented a very undesirable addition to the list of mines on our local exchange. In speaking of the company, a member of the Committee on Mining Securities said to an ENGINEERING AND MINING JOURNAL representative this week: "The pretensions of this concern were absurd. The company had recently been organized, and it was intended to lease the Silver King mine in Michigan, but the lease had not yet been consummated, and the company was actually endeavoring to have its stock listed before it owned any mining property at all. Furthermore, a friend writes me from Chicago that the promoters of this enterprise pretended that they were selling the same stock as that now dealt in here, which, you know, is of a company organized under California laws, and owns the Silver King mine of Arizona. This pamphlet will show what a large portion of the earth our Chicago friends claimed, and how very little of it they really owned."

From this pamphlet, which is issued by C. S. Northrop & Co., stockbrokers, 225 Dearborn Street, Chicago, Ill., we learn that the Silver King mine is located near Wakefield, Mich., within eighty rods of the Milwaukee, Lake Shore & Western Railroad. The exact location is given as N. ½, N. E. ¼, Sec. 23, R. 25, T. 47. The pamphlet says that several leads on the property have been traced 500 feet, that the ore can be mined and milled at \$3.50 per ton, leaving a net profit of over 700 per cent, and that a large smelter is being erected. An average of assays made by Mr. Chas. B. Gibson, "Analyst and Consulting Chemist," shows that the ore contains 19½ ounces silver. We should be pleased to hear from any of our Michigan exchanges or correspondents concerning this property.

The Consolidated California & Virginia Mining Company has not declared its usual dividend this month, but it is thought that the dividend will be resumed in April. The stock declined from \$8.13@ \$7.50 in the beginning of the week, but to-day advanced again to \$8.88. There is nothing of importance to note in the other Comstock shares.

Sutro Tunnel stock shows only one sale, at 9c. No transactions are reported in the Trust Certificates. Navajo shows a large business, selling at from \$1 to \$1.15.

Sullivan Consolidated was again active, but was firm at from \$1.45 to \$1.55. Homestake declined from \$12 to \$11. Deadwood Terra shows a sale at \$1.50. Caledonia declined from \$3 to \$2.85. Father de Smet has again appeared on the list, selling at from \$5 to 40c.

The Iron Silver Mining Company has, as predicted by the JOURNAL two weeks ago, declared a dividend of \$100,000. One sale of the stock was made at \$3.50. We publish elsewhere the re-organization scheme of the Little Pittsburg Mining Company which will be of value to those interested in this company. The stock is now selling at 8 @ 10c. Robinson Consolidated is quoted at 42 @ 43c.—Plutus was active at from 90 to 95c. Leadville was neglected at 14@15c. Chrysolite at 23 @ 24c. Adams at 28c. There were new transactions in Sylvanite. Denver City was quoted at 10c. Cashier at 8c.

The Eastern stockholders of the Hector Gold Mining Company, of California, have undoubtedly been badly "bitten," and the possibility of saving their stock without submitting to an indefinite number of assessments seems to be growing "beautifully less." Mr. Hermann Cohen, who has acted as chairman of the committee appointed at the stockholders' meeting in this city last month to look out for the interests of the Eastern shareholders, says that the contribution of two cents a share, for the purpose of preventing the levying of assessments has been paid on only 8000 shares and the \$160 thus secured, according to Mr. Cohen, is not sufficient to defray the expenses of pushing the suits against the company in the California courts. If only 8000 shares have contributed, there must be at least 22,000 held here which have not, and if the holders do not care to advance anything further on their shares, it looks as though the certificates will soon be valueless.

We learn from a correspondent that work is being actively pushed at the mines of the Plymouth Consolidated Mining Company, and that the working force is to be increased shortly. Twenty stamps of the mill are now in operation. The stock has been very active and advanced from \$11@13.13, declining later to \$12. Brunswick declined from 11@9c. Quicksilver preferred was lower, going from \$37@36, and common from \$6.13@6. Amador has declined to \$165. Astoria continued to sell at 20c. Middle Bar, for the first time, we believe, since it has been on the list, was not dealt in all week excepting to-day, when a sale of 300 shares was made at 30c per share. The only business in Hollywood was on Saturday, when it sold at 3c.

There was a downward tendency in Horn Silver which went from \$1.30 to \$1. We publish elsewhere extracts from the company's annual report. Ontario shows a few sales at from \$4 to \$33.50.

Kingston & Pembroke shows no life. Sales were made at from \$1.13 to \$1.25.

Alice receives no attention in this market; a sale was made at 75c.

There is nothing doing in Silver King, which is quoted at 80c.

Mutual remained steady all week at \$1.40.

Colchis showed a downward tendency, going from \$2.65@2.45.

There is no interest displayed in El Cristo, which remained firm at from \$1.20 to \$1.30.

United Copper advanced from \$1.30 to \$1.40.

**St. Louis Mining Stocks. March 10.**

**CLOSING PRICES.**

	Bid.	Asked.
Adams, Colorado.....	23¾	.25
Anderson, Montana.....	22½	.28¾
Aztec N. Mex.....	.41¼	.45
Bi-Metallic, Montana.....	40.00	41.00
Black Oak, California.....	.56¼	.57½
Carriboo, Idaho.....	.08½	.09
Central Silver.....	.22¼	.30
Concepcion, Mexico.....	.11	.12
Dinero, Colorado.....	.05	.08½
Golden Era, Montana.....	.16¼	.15¾
Go den King.....	.41¼	.45
Golden West.....	.58¾	.60
Granite Mountain, Montana.....	49.00	50.00
Hope, Montana.....	4.25	5.25
I. X. L., Colorado.....	.07½	.08
Jumbo, Colorado.....	.16¼	.20
Mary Foster, Colorado.....	.07½	.08
Major Budd, Montana.....	.09	.09
Mexican Imp., Mexico.....	.25¾	.26¼
Mountain Key.....	1.75	1.77½
Pat Murphy, Colorado.....	.31¼	.32½
Neath, Colorado.....	.17½	.20
Phillips, Colorado.....	.48¾	.50
San Francisco, Montana.....	.42½	.43¾
Small Hopes, Colorado.....	1.00	1.10
Silver Age, Colorado.....	2.73¾	2.30
West Granite, Montana.....	.70	.72¾
Wire Patch.....	.33¾	.35
Yuma, Arizona.....	.50	.51¼

**Boston. March 11.**

[From our Special Correspondent.]

The market for copper stocks is in a demoralized condition, and prices are very irregular, but the tendency is lower. The virtual collapse of the French syndicate has so unsettled matters that it will be a long while before confidence will be restored sufficiently to induce investors to put their money in this class of securities, and the outlook for the future is not very promising. The transactions in Boston & Montana the past week have been very large, aggregating over 18,000 shares, and prices have ranged from \$43 to \$37, with sales to-day at \$37 and \$38½. At present \$37 seems to be the point at which buyers are willing to go in, and it rallies from that price very quickly. Calumet & Hecla declined from \$25.6 to \$22.7, and rallied again to \$23.1, sales of about 700 shares.

Tamarack touched \$120, recovered to \$130, with last sales at \$128; Quincy declined from \$66@55; Franklin sold down to \$11½; Atlantic to \$12; Osceola declined from \$14@12½; and Kearsarge from \$8@6½, closing at near the lowest figure. Allouez continues to decline, and sold down to \$1½; National dropped to \$2¼; Huron to \$2½; while Pewabic is the

only stock which has maintained its price, all the sales being at \$5, same as last week.

Santa Fe held up pretty well early in the week at \$1 1/2 @ 1 1/8, but finally yielded to the inevitable and dropped to 1 1/8. There is no market for the low-priced shares, such as Arnold, South Side, Washington, etc., etc., and all anticipation of a boom in this class is indefinitely postponed.

Silver stocks continue dull, with sales of Dunkin at 97 1/2 c.; and Napa Q. at 83 1/2 @ 3 1/4. A dividend of 10c. per share is announced for the latter.

**FINANCIAL STATEMENTS.**

The financial balances of the following mining companies on March 1st were as follows:

CASH ON HAND.			
Alpha.....	\$16,624.52	Independence....	1,993.49
Alta.....	37,672.92	Justice.....	24,913.99
Andes.....	12,182.23	Lady Washingt'n.	23,831.30
Bullion.....	28,839.51	Locomotive.....	1,134.55
Best & Belcher.	1,797.25	Mono.....	10,797.81
Benton Cons.	95,572.62	Navajo.....	34,461.83
Bulwer.....	2,528.25	Ophir.....	8,751.32
Bodie Con.	30,865.52	Overman.....	22,820.22
Caledonia.....	13,903.87	Occidental.....	11,001.31
Chollar.....	3,136.35	Pondere.....	932.00
*Con. Cal. & Va.	64,717.66	Scorpion.....	7,989.00
Confidence.....	62,381.45	Standard Con.	20,262.78
Dudley.....	152.91	Syndicate.....	8,754.11
Excelsior.....	7,274.65	Union.....	13,047.93
Gould & Curry.	9,084.84	Utah Con.....	1,570.16
**Hale & Norcross	12,447.69	Weldon.....	156.47
Imperial.....	16,407.72		

\*\* Less \$7,217.68 due Virginia City office.  
\* With \$36,538.10 in unsold bullion, with the monthly expenses of the mine, amount unknown, to be paid.

**INDEBTEDNESS.**

Belcher.....	\$15,616.91	Mt. Cory.....	49,817.96
Belle Isle.....	3,407.46	Nevada Queen.....	40,013.24
Challenge.....	603.99	North Belle Isle.	14,016.69
Crown Pt.....	28,779.10	North Com'wealth	8,930.32
Commonwealth.	45,513.96	Peer.....	6,204.79
Con. New York.	6,605.50	*Peerless.....	7,400.92
Del Monte.....	653.96	Potosi.....	17,248.56
Grand Prize.....	40,959.06	†Savage.....	17,267.25
Holmes.....	3,491.13	Seg. Belcher &	
Kentuck.....	1,082.06	Mides Con.....	12,360.92
Mexican.....	763.31	Siera Nevada.....	2,803.03

\* Less \$5,143.32 in unsold bullion with further shipments to arrive.  
† With coin received by Superintendent on bullion account for February, amounting to \$6,657.95.

A number of the companies on the Comstock have paid their expenses for one month ahead, and this explains why the cash balances were so light in the above statements.

**Auction Sales of Stocks.**

The following securities were sold at public auction in New York this week:

Stock.	Shares sold.	Per value.	Price.
Consumers' Coal Co.....	100	85	50 per cent
Passaic Zinc Co.....	313	100	91
New Jersey Zinc and Iron Co.....	110	100	85
Union Phosphate Mg. & Land Co.....	100	10	50c. per share

**Pipe Line Certificates.**

In this, as in the market for mining shares, the reluctance of the public to trade prevents any real improvement in prices. No one defies that the statistical position is strong, and that certificates are extremely scarce is daily becoming more apparent. The week's transactions have been very limited. The market has received little or no support. The opening quotation on Monday was 90%. Since then as high as 91% has been reached. Oil closed to-day at 89 1/2 c.

**NEW YORK EXCHANGE.**

Mar. 9.....	Opening.	Highest.	Lowest.	Closing.	Sales.
11.....	91 1/2	91 1/4	90 3/4	90 1/2	179,000
12.....	91 1/4	91 1/4	90 3/4	91 1/4	272,000
13.....	91 1/4	91 1/4	90 3/4	91 1/4	209,000
14.....	90 3/4	91 1/4	88 1/4	89 3/4	1,070,000
15.....	90	90 3/4	89	89	600,000
15.....	90	90 3/4	89 1/2	89 3/4	402,000

Total sales in barrels..... 2,732,000

**CONSOLIDATED STOCK AND PETROLEUM EXCHANGE.**

Mar. 9.....	Opening.	Highest.	Lowest.	Closing.	Sales.
11.....	91	91 1/4	90 3/4	90 3/4	352,000
12.....	90 3/4	91 1/4	90 3/4	91 1/4	357,000
13.....	91 1/4	91 3/4	90 3/4	91 3/4	116,000
14.....	90 3/4	91 1/4	88 3/4	89 3/4	1,885,000
15.....	89 1/4	90 3/4	88 3/4	90 1/4	1,233,000
15.....	90	90 3/4	89 3/4	89 3/4	497,000

Total sales in barrels..... 4,450,000

**Electric Stocks.**

In the United States Court, at Pittsburgh, on the 13th inst., counsel for the Edison Electric Company asked ten days additional time for the taking of testimony in the case of the Westinghouse Electric Company against the McKeesport Company, an Edison company. The thirty days additional time previously granted the Edison people expires one week from to-day. Judge Acheson granted three days extension, that is, until Saturday, March 23d. There was great excitement in Westinghouse electric stock on the Pittsburgh Petroleum and Stock Exchange on the 14th inst. afternoon, \$54 1/2 being bid at the last call. Eight months ago it was selling at \$18 a share and had only advanced to \$24 in November at the office of the company. The advance was said to be due to heavy buying from New York, Philadelphia and Boston, principally from the latter city. General Manager H. M. Bylesby is reported to have stated that there is absolutely no foundation for the report that the Westinghouse Company had sold its patent rights

in Great Britain for \$2,000,000, and would declare a stock dividend.

A later dispatch dated Pittsburg, March 15, says: Westinghouse electric stock, opened this morning holders very firm, holders demanded \$57 per share, but finally accepted \$56.50. A large amount of stock changed hands at this figure.

Boston advices state: Thomson-Houston stock sold in Lynn on the 11th inst. at \$285 and Electric Welding Company at \$425.

**Trust Stocks.**

The following are the closing quotations to-day prepared for the ENGINEERING AND MINING JOURNAL by Messrs. C. I. Hudson & Co., Brokers, New York City:

Stock.	Par value.	Market price
White Lead Trust.....	\$100.....	\$21 @ \$22
Standard Oil Trust.....	100.....	167 @ 170
Sugar Refineries Trust.....	100.....	83 1/4 @ 83 3/4
Whiskey Trust.....	100.....	35 1/4 @ 36

Some interesting information regarding the National Lead Trust is given by Watson & Gibson. The trust has been in existence about a year and a half and controls twenty-one out of thirty-one corridors of lead in this country. Its capital of \$38,000,000 nominal is estimated to be fully four times the actual value of the property, but it is said that the surplus is accumulating at the rate of 5 per cent to 6 per cent per annum on this capital. The president is H. Hentz, formerly president of the Cotton Exchange, and the treasurer Mr. Thompson, president of the Bank of Commerce, of St. Louis.

**COAL TRADE REVIEW.**

NEW YORK, Friday Evening, March 15.

**Statistics.**

PRODUCTION OF ANTHRACITE COAL for week ended March 9th, and year from January 1st.

Tons of 2240 lbs.	Week.	Year.	Year.
P. & Read, R.R. Co.....	79,298	1,008,560	491,324
Cent. R.R. of N. J.....	73,280	891,248	816,661
L. V. R.R. Co.....	133,971	1,256,440	782,577
D., L. & W. R.R. Co.....	73,858	700,553	1,431,823
D. & H. Canal Co.....	64,526	677,864	933,684
Penna R.R.....	59,217	579,087	757,959
Penna. Coal Co.....	15,223	137,797	316,883
N. Y., L. E. & W.....	18,000	223,994	159,240
Total.....	517,373	5,475,543	5,690,151

Decrease..... 214,608

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:  
1884..... 4,915,253 1886..... 5,880,869  
1885..... 4,538,398 1887..... 6,101,947

PRODUCTION OF BITUMINOUS COAL for week ended March 9th, and year from January 1st.

Tons of 2240 lbs.	Week.	Year.	Year.
Phila. & Erie R.R.....	1,933	18,501	9,886
Cumberland, Md.....	47,458	525,021	601,554
Burley, Pa.....	3,009	27,003	35,000
Broad Top, Pa.....	7,575	84,306	90,538
Clearfield, Pa.....	63,551	617,138	703,591
Allegheny, Pa.....	17,374	171,310	174,493
Pocahontas Flat Top.....	31,353	287,926	270,067
Kanawha, W. Va.....	132,291	323,621	341,516
Total.....	204,515	2,054,826	2,226,645

† Week ending March 7th.

WESTERN SHIPMENTS.	Week.	Year.	Year.
Pittsburg, Pa.....	10,767	121,400	144,834
Westmoreland, Pa.....	28,273	317,244	283,185
Monongahela, Pa.....	3,362	30,434	58,076
Total.....	42,402	469,078	486,095

Grand total..... 246,917 2,523,994 2,712,740

PRODUCTION OF COKE on line of Pennsylvania R. R. for week ending March 9th and year from January 1st, in tons of 3000 lbs.: Week, 85,004 tons; year, 859,682 tons; to corresponding date in 1888, 770,855.

**Anthracite.**

On the 14th inst., the sales agents of the anthracite companies held a meeting, at which the Spring prices were announced, and it was recommended that the output for April be 2,000,000 tons. The output for the present month will be something more than this, or about 2,500,000 tons. The basis for output is that of the maximum output of last year. The average of the three months, August, September and October, of last year, when all the companies were producing all they could, is assumed to be the capacity of all the mines, and it makes an average of 4,067,138 tons a month. The amount to be mined during a month hereafter will probably be based upon this; that is, it will be a percentage of this. The proportion which each of the companies is to produce will also be based upon the proportion which they produced in those three months. At least this is the general supposition, though since there is no absolute agreement it is merely a convenient way of arriving at the production to be made at any period during the year by these several interests. The production of April will therefore be about 50 per cent of the maximum production.

The prices which have been named for the present month and for April are as follows: Broken coal, \$3.75; egg, \$3.90; stove, \$4.15; chestnut, \$3.90. This includes the usual 15 cents commission. These prices are a compromise, some of the companies wishing to keep them up to a point 10 or 15 cents above these figures, others wishing to reduce them as much below this. As we stated last week we think it would have been wiser to have made the opening price lower, but since it is now made it is all important that it should be maintained,

and that it should prove the lowest of the year. The price is named for the current month and April only, and no doubt in May an advance will be made though it may not be a very large one.

The utmost harmony prevailed at the meeting of the sales agents, and we believe that the Reading official who was so communicative to the newspapers of late, and so uncomplimentary to the sales agents, has had an opportunity to revise his opinion and that he has modified his expressions materially.

Thus far the naming of Spring prices has not improved trade, the demand is very light and individual operators are still shading the prices. We do not anticipate a very brisk demand for some time to come. There is no price named for pea and buckwheat coal; these are to be sold in competition with bituminous coal and the prices will be whatever can be obtained. \$2 to \$2.50 are at present fair prices for pea coal.

The Philadelphia & Reading Coal & Iron Company has named the following prices f.o.b. Port Liberty, New York harbor.

	Lu'p	S.B't	Bro.	Egg.	Sto.	Ch't	Pea.
Hard white ash.....	\$4.25	\$4.25	\$3.50	\$4.00	\$4.15	\$4.00	\$2.50
Free white ash.....	3.75	3.90	4.15	4.00	4.15	4.00	2.40
N. Frank. wh. ash.....				4.15	4.15	4.00	
Shamokin.....				4.00	4.40	4.10	
Schuylkill R. A. and Lorberry.....				4.25	4.75	4.25	
Lykens Valley.....			\$4.75	5.25	5.25	5.00	

**Bituminous.**

This week the Seaboard Association issued its prices and made its new "iron clad" agreement operative. The prices are, as we have already announced, \$2.60 f.o.b. Baltimore and \$3.50 alongside New York. The new agreement went into force yesterday, and it is to continue for three years. Each company is to pay in as a forfeit 20 cents a ton on the coal it ships until a large forfeit be thus accumulated. It is believed that this will be sufficient to induce these honorable gentlemen to keep their agreement. Of course every one understands that such an arrangement would not stand in a court of law, but it would be extremely difficult for a company that had already paid in its money to get it back if it violated its agreement.

The ink was not dry upon the signatures to this important document when we heard well substantiated reports of contracts having been made at considerable reductions from the stipulated price. These contracts were made, however, before the agreement became operative, that is, before yesterday. It is true that all the interests had agreed to stand by the terms and not to sell any coal below the figures named. One might have supposed that persons as conscientious as the gentlemen who manage the bituminous coal companies would have hesitated about accepting contracts at figures which were not in accordance with the terms they had agreed to maintain, even though strictly speaking the commissioner could not enforce the agreement for a few days at least.

This supposition is not a safe one to make in treating of the coal trade. The facts are that large contracts have been made in the East at prices "delivered on the cars at the consumer's works," and the figures are such that even with the present extremely low rates of freight they would bring nothing like \$2.60 on board at Baltimore. We do not pretend to offer any explanation of this action, but we record the fact, which can readily be substantiated. It is also well-known that the few companies which supplied the steamship trade in this harbor sell their coal considerably below \$3.50, which is the stipulated price. In fact it is quite improbable that any of the steamship companies here pay \$3.50 for their coal. How they get the lower rates in the face of the company's agreement is also a conundrum which we are unable to solve. We submit both of these to the managers of the largest interests in the Cumberland and Clearfield districts.

The Baltimore & Ohio Railroad Company is soon to take an important step in the development of its Cumberland soft coal traffic to Philadelphia. A very large coal wharf is to be built at the Delaware, foot of Snyder avenue, on property which the company has owned for some time. This will very largely increase seaboard shipments, and such companies as the Consolidation, which is controlled by the Baltimore & Ohio Railroad, and the George's Creek will find a large extension of the market for their product.

**BOSTON.**

March 14.

The anthracite coal market takes all its news from the New York end of the line this week. There is nothing going on here, and it makes very little difference what f.o.b. prices are. It is beginning to be understood here that the f.o.b. prices of \$3.75 for broken, \$3.90 for egg, \$4.00 for nut and \$4.15 for stove, as adopted at the New York meeting, were compromise figures, several of the smaller companies desiring decidedly lower prices than could be agreed upon. The result is that the new prices represent the market nominally and not actually. They are higher than coal has actually been selling by individuals for thirty days or more, and no one who is not bound to have company coal will pay the new prices. Individual operators are cutting the new rates 10 to 15 cents, but no one is doing much business.

If the companies had cut prices down to a basis of \$4 for stove coal, and kept tolls where they are, they could have kept outsiders from cutting, but it is to be presumed the companies know their business best; they have certainly done well during the past season. Restriction has been very heavy, and was never so



well maintained. Thus, for 1889, some of the companies have mined scarcely half their percentage. Owing to the curtailed production the supply of pea and buckwheat is much smaller than usual, and prices are relatively firm at say \$2.75 for Delaware & Hudson pea (and there is very little of any other kind) and \$2 for buckwheat. Hard coal of these sizes runs from 25 to 50 cents per ton lower. Take it all in all, the market is still a waiting one, and it is an even thing if f.o.b. prices do not ease off 10 to 20 cents more before anything is done. The companies are very independent, however. As it now is, individual operators will continue to do most of the business.

In the line of bituminous nothing of material importance has developed locally. Every one is waiting to hear the result of the pool meeting in New York today, and I presume it will be given in your New York market report. While the f.o.b. price of \$2.60 is made, this final meeting is required to put matters in shape. While nothing has been actually contracted for, a good many contracts are out of the market, upon the guarantee of some preferred shipper that the buyer shall be given the lowest prices. No large contracts reported taken as yet outside of the Fitchburg Railroad water freight coal.

Freight rates are low and weak. A large vessel or barge could probably be had from New York for 70 cents, and from that up to 85 cents as an outside figure. Philadelphia rates are down to 90 cents, and Baltimore to \$1 to Boston, and 80 cents to Sound ports. Very few cargoes comparatively are being shipped.

The retail trade has at last reduced prices 50 cents per ton to the following for 2000 pounds delivered: Free burning, Stove \$6 per ton; Nut, \$5.75; Egg, \$5.75; Furnace, \$5.50; Burnside, \$6.50; Franklin, \$7.25; Lehigh Furnace, \$5.75; Lehigh Egg, \$6. Wharf prices 50 cents less. Cumberland at wharf, \$4.25; screenings, \$2.50.

The combination has served successfully to hold up prices this season. Retail movement is very small.

Receipts for the week are 7206 tons anthracite, 18384 tons bituminous, total for the year, 126,765 tons anthracite, 160,629 tons bituminous.

**BUFFALO, March 14.**

[From Our Special Correspondent.]

Quotations for anthracite and bituminous coal without variation. On the 1st of April a new schedule is expected to come into operation for anthracite, but the figures have not been made public. Coke unchanged and quiet.

Trade is quiet, and with no special features to report. The stocks of anthracite slowly on the increase and bituminous fully adequate for all the requirements of the small demand, with surplus on tracks adequate for several weeks' consumption.

The weather continues mild, and to-day is positively hot.

The improvements on the docks, trestles, etc., are progressing satisfactorily and rapidly in consequence of the weather, enabling the workmen to labor steadily and on full time.

**PITTSBURG, March 14.**

[From our Special Correspondent.]

Coal.—We have to report a dull and unsatisfactory market. Prices weak, with a very limited demand. The late coal run was a very successful one; not a single loss reported. The largest portion was shipped to the Southern markets. The impression still prevails that unless the price of mining is reduced there will be a shut-down.

The nominal rates are:  
PRICE OF COAL PER 100 BUSHELS = 7600 LBS.  
First pool ..... \$4.75 | Fourth pool ..... \$3.25  
Second pool ..... 4.50 | Railroad coal ..... 5.00@5.25  
Third pool ..... 3.90

Connellsville Coke.—The market was dull, without any quotable change in prices. There are quite a number of ovens closing down, as the supply exceeds the demand. Week's production shows an increase over preceding week, 751 cars. Indications are that the production is now keeping practically within the demand instead of exceeding it, as it did at the date of last report.

Nominal rates at the ovens:  
Furnace Coke ..... \$1.25@1.35 | Foundries ..... \$1.50  
Crushed ..... 2.20

Freight rates from the ovens to Pittsburg, 70c. per ton; to the Mahoning and Chenango valleys, \$1.35; East St. Louis, \$3.20; Cleveland, \$2.80; Chicago, \$2.75.

**METAL MARKETS.**

NEW YORK, Friday Evening, March 15, 1889.  
Prices of silver per ounce troy.

Mch	Sterling Exch'ge	Lond'n Pence.	N. Y. Cts.	Mch	Sterling Exch'ge	Lond'n Pence.	N. Y. Cts.
9	4.88 3/4	42 1/2	93	13	4.88 3/4	42 1/2	93
11	4.88 3/4	42 1/2	93	14	4.88 3/4	42 1/2	93
12	4.88 3/4	42 1/2	93	15	4.88 3/4	42 1/2	93

Silver market has been very steady without special feature this week.

Council Bills remained unchanged on Wednesday. The United States Assay Office at New York reports total receipts of silver for the week 103,000 ounces.

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 3 per cent. During the week the bank gained £153,000 bullion, but the proportion of its reserve to its liabilities

was reduced from 42.79 to 42.09 per cent, against a reduction from 45.42 to 44.43 per cent in the same week of last year, when its rate for discount was 2 per cent. Thursday the bank gained £17,000 bullion on balance. The weekly statement of the Bank of France shows a loss of 775,000 francs gold and a loss of 1,475,000 francs silver.

**Domestic and Foreign Coin.**

The following are the latest market quotations for American and other coin:

	Bid.	Asked.
Trade dollars.....	.72	.72
Mexican dollars.....	.72 3/4	.73 1/4
Peruvian soles and Chilean pesos.....	.71	.72
English silver.....	4.83	4.87
Five francs.....	.94	.95
Victoria sovereigns.....	4.86	4.88
Twenty francs.....	3.88	3.92
Twenty marks.....	4.74	4.80
Spanish doubloons.....	15.00	15.75
Spanish 25 pesetas.....	4.80	4.86
Mexican doubloons.....	15.55	15.70
Mexican 20 pesos.....	19.50	19.65
Ten guilders.....	3.96	4.00

Copper.—Saturday last (the date of our last issue) witnessed the outbreak of a semi-panic in Paris, the effect of which was reflected on all the principal money centers, both in Europe and in this country. The shock was caused by the announcement of the virtual breakdown of the French copper syndicate, and the result was a pretty general decline in the values of securities dealt in on the principal Exchanges, and more especially in everything connected with copper mining and the operations of the Syndicate. In this latter connection we may instance the Comptoir d'Escompte, an institution only second in importance to the Bank of France (and in fact, a sort of semi-official body) the shares in which, owing to the way in which it was involved in the operations of the copper syndicate, fell in one day during the week to the low point of 305 francs, recovering a little later to 400 francs, but closing rather weaker again at 320 francs. The shares of the Societe des Metaux, which about the end of last year touched 1200 francs, came down to 80 francs, and it seemed as if a great financial catastrophe was imminent. This was, however, averted by an advance of one hundred million francs by the Bank of France, such advance being guaranteed by all the principal financial houses in Paris. Shortly afterwards it transpired that the sale of the bulk of the copper held by the syndicate had been placed in the hands of the strong and well-known financial house of Matheson & Co., in London, from which it is evident that the power of the once almost omnipotent French Copper Syndicate is now completely broken, and that the control of the market in the future and the disposal of the accumulated stocks has passed into entirely different hands. When these facts became known the price of Chili bars and G. M. B. copper in London, which had dropped on Monday to £50 per ton spot and £47 to £48 3 months, became somewhat excited, and a considerable amount of buying took place more especially on the part of operators who had previously sold short in view of the threatening condition of affairs. Owing to these operations prices were rapidly driven up to £58 for spot G. M. B. and Chili Bars, but when that point was reached a sharp reaction set in which has been continued with almost uninterrupted progress from day to day. The following are the London closing quotations for Chili Bars and G. M. B. copper during the past week:

Some reports have been circulated on this side that a large quantity (said to be 5000 to 7000 tons) of furnace material has been sold during the week from England to Germany, on the basis of £57, but we have no confirmation of this reputed sale and have reason to question its accuracy. With the exception of the transactions in the speculative markets dealings have been practically paralyzed. A few unimportant bargains have been struck, but too insignificant to be regarded as an indication of current values, and as futures are still quoted below the price of spot copper, and great uncertainty still prevails as to the future, this reluctance to enter into any important trading is not at all surprising.

It is reported from Boston that the Lake companies will keep the prices in this country up at about present level until the end of May, the time at which the last pool sale contracts, at 16 1/2 c. per pound, expired. This action seems not improbable, seeing that the companies are secured up to that time under their bankers' letters of credit.

It seems very doubtful, however, whether the arrangement arrived at last week, under which the principal producers in this country agreed to reduce their output from 15 to 25 per cent will be carried out, as it is exceedingly unlikely that these bankers' guarantees will be renewed again in May for the unexpired period of the syndicate's contracts, that is to May, 1891.

Until all these questions are settled and a definite understanding arrived at embracing the holders of the large stocks of copper (amounting altogether to about 150,000 tons) and all the producers throughout the world, it can easily be seen that confidence in the future of the market cannot be re-established. On the other hand, as the stocks are now in strong hands, it is not likely that a complete collapse in prices will take place, but

it must take a few weeks at the least to bring about some satisfactory arrangement between all the parties interested.

It is understood that Mr. Haggin and the representative of the Calumet & Hecla sail for England tomorrow to endeavor to reconstruct an arrangement for the control of the copper markets.

The market here has been quite nominal throughout the whole of the week, with only a few small transactions reported in lake copper at 16c. spot and casting copper at 15c. spot, but these figures cannot be regarded as anything like established values the market as before stated being entirely nominal, there being absolutely no buyers at the moment. This afternoon a sale of casting copper, March, at 14 cents is recorded.

A serious fire is reported at the Anaconda Smelting Company's works, the lower works, just nearing completion having, it is said, been partially destroyed. Since these works were only under construction, their loss cannot reduce the present output.

Tin.—Throughout the whole of the week tin has been firmly held, and a fair amount of business has been done. Spot tin has sold at 21 1/2, and is still inquired for at that price. We quote spot and March, 21 1/4 @ 3/4; April, 21 3/4; May, 21 3/4; June, 21 1/2. The London market has also been very steady, with fluctuations very slight and prices close, about the same as last week, viz., spot, £94 15s; three months, £95 10s.

Lead.—The market was very quiet up to Thursday, when a little speculative buying set in. Spot selling at 3 7/8, April at 3 7/8, and August at 3 3/4. This buying did not continue long, however, and prices close easier again at 3 7/8 for near deliveries. The London market has recovered somewhat from the sharp decline of last week, and Spanish lead is now quoted at £12 12s. 6d., English at £12 17s. 6d.

The Chicago Market.—Messrs. Everett and Post, of Chicago, telegraph us to-day as follows: The market remains about the same, if anything a shade firmer. Demand is only moderate and but very little doing. Locally there are rumors of sales of 500 tons desilverized April for shipment at 3 5/8c. Asking prices are 3 5/2 @ 3 6/8c.

The St. Louis Market.—Messrs. John Wahl & Co. telegraph us to-day as follows: Subsequent to our last weeks report, a few hundred tons were sold at last named price (3 4/8c.), when suddenly a stronger feeling manifested itself and a few small lots have been placed at 3 5/8c. There is a fair inquiry, and the market closes firm at 3 4 1/2 c. bid, and 3 5/8 c. asked.

Spelter.—There is considerably more buying going on, but prices are again a little lower, prime Western having been sold at \$4 75. Foreign quotations are unchanged.

Antimony is unchanged. Hallet's at 12 1/2 c and Cookson's at 14c.

**IRON MARKET REVIEW.**

NEW YORK, Friday Evening, March 15, 1889.

American pig.—This market is extremely dull and lifeless. There is no foundation for reporting any substantial improvement in it, though there are those who would like to have consumers believe prices are about to improve or that the demand is increasing. In other parts of the country an effort was made about two weeks ago to produce a small boom but it died out before it got here, and the most that we were able to report was a somewhat better "tone" to the market. Now even this has disappeared, and prices remain just as they were with very little doing, and very little expectation of any substantial improvement for some months to come. Our quotations of \$15 for Forge, \$16 to \$17 for No. 2, and \$17 to \$18 for No. 1 X foundry still hold good, and it is also certain that lower prices than these have been named. We hear of a sale of 800 tons Southern iron equal to No. 2 X delivered at Troy for \$16.70 per ton. Agents for the Tennessee Coal and Iron Company and the Sloss Iron and Steel Company report sales aggregating 1200 tons and claim that they are getting standard prices for their irons.

Bessemer Pig.—There is very little doing in this article; nothing is imported, American brands selling at from \$16 to \$17 a ton, which is very considerably below the cost of importation of foreign iron.

Scotch Pig.—The foreign market has continued to advance, making it increasingly difficult to do business here. Freight rates are still down to 3s. a ton, and we may quote Coltness at about \$21; Dalmellington, \$19.50; Gartsherrie, \$20.75; Langloan, \$20.50; Glengarnock, \$20, and Eglinton, \$19.25.

Ferro manganese is somewhat firmer and we quote from 56.50 to 57 for 80 per cent. Spiegeleisen may be quoted at 28 for 20 per cent without any life in the market.

Structural Iron and Steel.—The demand continues quite active, several large orders being in the market and some of them it is expected will very shortly be placed. Prices are very low, ranging from 1 85 @ 2c. for plates and angles and 2 25 @ 2 5c. for Ts, channels; beams are 2 8c. on dock as heretofore. It is said that the North Chicago Rolling Mill Company has joined the Beam Association; the only mill now out is the Allentown rolling-mill.

Steel Rails.—Some fair orders have been placed during the week, possibly from 25,000 to 30,000 tons, mostly for Southern roads. The Bethlehem mill has taken a portion of these orders, the Lackawanna a portion, and some of the remainder has gone to other Eastern mills. The Board of Control statistics show that 590,000 tons of rails have been sold to the 1st March, this being about 200,000 less than the allot

ment. The shipments to the 1st March were only about 143,000 tons.

The consolidation of the Chicago steel mills which we announced last week is expected to improve prices somewhat in the west for some of the Chicago mills were given to naming very low figures.

Old Material.—Old rails are very weak in this market, though held in very small quantities.

Scrap Iron is worth from \$20 to \$21, with a very light demand. Quotations for the other articles on our list will be found in our usual table of Current Prices on another page, the market having no features worthy of special mention.

PHILADELPHIA. March 15.

[From our Special Correspondent.]

Up to this writing steel rail contracts reported for all quarters in this market foot up about 50,000 tons. Offers have been made by railroads for about 15,000 tons, but their financial affairs are not in shape as yet to pay cash, and the offers have been declined, as rail-makers do not care to assume the task of negotiating bonds for roads, no matter how well backed.

A rather discouraging report has been made by the various merchant steel manufacturers this week. Some parties are cutting prices and this has led to the diversion of business which was to have been placed in eastern Pennsylvania.

Other branches of the iron trade are without special interest. In skelp iron very little business is being done, notwithstanding skelp is offered at lower prices than it has been for months.

facturers are very confident of some of the largest orders of the season in the course of a few days. The nail trade has not improved, notwithstanding large building operations are setting in.

A few good orders for plate and tank material have just been placed and manufacturers say there is more business in sight just at present than for some weeks past.

No large sales of old rails have been made and prices are nominally unchanged. There is a more active inquiry for scrap iron and yardmen are increasing their yard supplies.

For quotations see table of current prices on another page.

PITTSBURG. March 14.

Raw Iron.—The market during the week has presented nothing very new or important. There was a fair volume of business, with prices maintained, and holders of favorite brands mill iron are contending for more money and in some cases have obtained it.

Most of the city furnaces are running to their full capacity. This evidently shows confidence in the future. Old iron rails are dull, demand and sales

light. The stock in first hands is limited. Muck bar about holds its own. Ferro-manganese is firm, with a material advance in prices within a short time.

On the whole, the market was steady with a fair probability of the present status being maintained or improved.

Table of prices for various iron and steel products including Bessemer, Gray, and Muck bar, with prices in cash and mo.

CHEMICALS AND MINERALS.

NEW YORK, Friday Evening, March 15 Heavy Chemicals.—A slight change for the better is noticeable in this line of the chemical trade.

IMPORTS AND EXPORTS OF METALS AT NEW YORK MARCH 6th TO MARCH 8th, 1889, AND FROM JANUARY 1st.

Large table with multiple columns showing import and export data for various metals like Spelter, Nickel, Antimony, Pig Lead, Tin, Tin Plates, Steel Sheets, Billets, Forging, etc., with columns for Week, Year, Tons, and Lbs.

CURRENT PRICES.

CHEMICALS.

Table of chemical prices including Acetic, Muriatic, Nitric, Sulphuric, Ammonia, and various salts and acids.

Table of building materials including Bricks, Tiles, and various types of stone and cement.

Table of iron and steel prices including American Pig-Iron, Scotch Pig-Iron, and various steel products.

Table of rarer metals including Aluminum, Bismuth, Cadmium, Cerium, and various other elements.

Table of common metals including Copper, Lead, Tin, Zinc, and various alloys.

Table of iron and steel prices (continued) including various grades of iron and steel.

Table of iron and steel prices (continued) including various types of iron and steel.

Table of iron and steel prices (continued) including various grades of iron and steel.

Table of iron and steel prices (continued) including various types of iron and steel.

Table of iron and steel prices (continued) including various grades of iron and steel.

Table of Philadelphia prices including Foundry No. 1, Foundry No. 2, and various iron products.

Table of Philadelphia prices (continued) including various types of iron and steel.

Table of stock market quotations including Atlantic Coal, Balt. & N. C., and various other stocks.

Table of stock market quotations (continued) including various types of stocks and bonds.

Table of stock market quotations (continued) including various types of stocks and bonds.

Table of stock market quotations (continued) including various types of stocks and bonds.

Table of stock market quotations (continued) including various types of stocks and bonds.

DIVIDEND-PAYING MINES.

NON-DIVIDEND-PAYING MINES

Main table with columns: NAME AND LOCATION OF COMPANY, CAPITAL STOCK, SHARES, ASSESSMENTS, DIVIDENDS, and NAME AND LOCATION OF COMPANY, CAPITAL STOCK, SHARES, ASSESSMENTS. Contains 160 rows of mine data.

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 \$275,000 in eleven dividends, and the Terra \$75,000. ¶ Previous to the consolidation of the Copper Queen with the Atlanta. Aug. 1885, the Copper Queen had paid \$1,250,000 in 4 dividends, and \$1,000,000.

NEW YORK MINING STOCKS QUOTATIONS.

Table with columns for 'DIVIDEND-PAYING MINES' and 'NON-DIVIDEND-PAYING MINES'. Each section lists company names and their stock prices for various dates from March 9 to March 15, 1889. Includes a 'SALES' column for each entry.

\*Ex dividend. Deal in at the New York Stock Ex. Unlited securities. †Assessment paid. Dividend shares sold, 21,720. Non-dividend shares sold, 55,200. Total New York, 76,970.

BOSTON MINING STOCK QUOTATIONS.

Table listing Boston Mining Stock Quotations with columns for company names and stock prices from March 8 to March 14, 1889. Includes a 'SALES' column.

Boston: Dividend shares sold, 24,773. Non-dividend shares sold, 12,690. Total Boston, 37,463.

COAL STOCKS.

Table listing Coal Stocks with columns for company names, prices for various dates from March 9 to March 15, 1889, and sales figures.

\*Of the sales of this stock, 63,836 were in Philadelphia, and 283,500 in New York. Total sales, 347,336.

San Francisco Mining Stock Quotations.

Table listing San Francisco Mining Stock Quotations with columns for company names and closing quotations from March 8 to March 14, 1889.

quired for, and brings full price. We quote on the spot 1 25c. in a large way. Caustic soda ash, 48 per cent, continues quiet, but seems to be rather firm at 1 25@1 30c., the latter figure being for small lots.

Refined alkali is in good demand at 1 15@1 20c. for 58 per cent, and 1 25c. for 48 per cent.

Caustic soda also shows a little improvement and an advance is uniformly reported. Spot stock is not so large as formerly, several lots having been put in store, the consignees being unwilling to let them go at present prices, and there is also less afloat than usual. Fair quotations for the higher tests are now 2 17½@2 20c., and for 60 per cent 2 35@2 40c.

No change in either American or English sal soda is reported.

Bleaching powder has not been improved either in position or price, and 1 75c. probably represents the market, although for favorite brands importers claim to be able to secure as high as 1 90c.

From the report of the Bureau of Statistics issued this week, we take the following statistics of imports during January:

	1889.	1888.
	January.	January.
Bleach, lbs.	276,900	303,013
Soda: Bicarbonate	206,633	78,400
Carbonate	26,944,915	24,108,192
Caustic	7,832,879	8,153,412
All other salts of	2,128,350	2,035,203
Nitrate, lbs.	21,281,975	12,942,744
Potash, Muriate, lbs.	3,320,504	4,311,890
Nitrate, lbs.	223,972	337,843
Sulphur, crude, tons	17,122	3,717

\* Including sal soda and soda ash. † A ton of nitrate of soda is estimated at 7½ bags.

**Acids.**—This market is practically unchanged. There is a very fair movement of the leading descriptions, principally sulphuric, but no quotable change in prices is reported. A firm, healthy tone prevails, even if prices are rather low. The situation is about as follows: Acetic is not wanted at 2½; nitric, quiet at 4@7c.; muriatic, fairly active and firm at 1 15@1 20c. for 18 degrees to 1 40@1 60c. for 22 degrees, and sulphuric moving freely at 95c. for 66 degrees. The only "news" of the week is in regard to the efforts that are being made to have all the local manufacturers unite in sending a delegation to Congress to petition for the impost of a duty of either 25c. or 50c. a pound on all acids imported. At first it was intended to "protect" only sulphuric, but now we understand that all descriptions are to be included. This movement has been contemplated for some time past, but it has just taken definite shape. The gentleman, who is most prominent in promoting the scheme, was seen by a representative of the ENGINEERING AND MINING JOURNAL this week. He said: "This step is for the purpose of shutting out several Canadian and English houses, who are making arrangement to flood this and the New England market with cheap pyrites acid. There is one firm that has already brought from Canada a large amount in tank cars over the Grand Trunk Railway, and I am informed that English capitalists intend to erect additional factories. Therefore, although New York manufacturers have not yet begun to feel the effects of this Canadian competition, we fear that unless some steps are taken to prevent it immediately, it will grow to be a thorn in our sides which, taken together with the fierce competition now existing among our manufacturers, will place the American acid trade in a precarious condition. Already seven makers have agreed to unite in this petition, and action will be taken in the matter as soon as possible."

**Fertilizers, etc.**—Trade in this department is quiet, but on the whole dealers appear to be able to sustain prices at about former figures, which may be written as follows: Azotine, \$2.75; dried blood (city), low grade, \$2.65@2.70 per unit; Western, high grade, \$2.75 per unit for ground material; tankage, high grade, \$25@26 per ton; low grade, \$24 per ton, as to quality. Fish scrap, \$25@26 per ton f.o.b. factory. Sulphate of ammonia, \$3.35@3.40 per cwt.

Refuse bone-black, guaranteed 70 per cent phosphate, is quoted at \$19.50 per ton. Dissolved bone-black is 95c.@1 per unit for available phosphoric acid, and acid phosphate 85@90c. per unit for available phosphoric acid.

Steamed bones, unground, \$19.50; ground, \$25@26.

Charleston rock, undried, \$5@5.25 per ton; kiln dried, \$6@6.25 per ton, both f.o.b. vessels at the mines. Charleston rock, ground, \$10@10.50 ex steamer at New York. Our Charleston, S. C., correspondent reports shipments of phosphate rock from that port during February as follows:

	1889.	1888.	1887.
	13,828	13,680	14,309
Crude, tons	670		
Ground, tons			

During February, 1889, no shipments were made to foreign ports. Of the domestic shipments given above, New York received direct 1190 tons crude and 670 tons ground.

The imports of phosphates, crude or native, for fertilizing purposes, as given by the Bureau of Statistics, during January, 1889, aggregated 5598 tons against 6521 tons in January, 1888.

**Muriate of Potash.**—During the past week the official prices have been sustained, but within a day or two it is expected that the syndicate will reduce its rates. On Wednesday of this week, according to cablegrams just received, the River Elbe was opened for navigation, and as this will reduce the cost at point of shipment, prices should be a little easier here. This week's prices have ranged from 1 82½@1 90c. on the spot, according to quantity, and 1 82½@1 85c. to arrive.

Double manure salts are quiet, at 1 20c. on the spot,

basis of 48 per cent potash. High grade sulphate of potash, basis 90 per cent, is held at 2 35c. spot, and 2 50c. for futures. Readers unacquainted with the situation may be surprised at a lower quotation for spot than for futures. The reason for this is that 2 50c. is the price now fixed by the syndicate, while the lot now on the spot were purchased by local dealers before the syndicate raised its prices.

Kainit can be had in small lots on the spot at \$10@10 50. Futures are quoted at \$9.75.

Brimstone is weaker than at the date of our last report. One firm reports a sale of 100 tons of best unmined seconds on the spot as low as \$20. The usual range is \$20 25@20.50.

Nitrate of soda is quoted at 2 35@2 40c. spot, and 2 15@2 27½c. for futures, according to location.

**A Salt Trust Forming.**—The salt producers are, it is thought, trying to form a salt trust, although they are so secretive that nothing definite can be learned by the public. On the 9th inst. the Michigan Salt Producers' Association held a secret meeting at East Saginaw, and on the 13th inst. were again in session in that city in consultation with E. F. Burger, of New York. Mr. Burger is said to represent the Eastern salt men, and has brought a proposition with him regarding prices, which is now being discussed.

**Liverpool.** March 2. [From our Special Correspondents.]

**Chemicals.**—Messrs. J. P. Brunner & Co. write us as follows: The depression in heavy chemicals still continues, and at the moment there does not seem much prospect of an early improvement. Soda Ash—There are a few orders coming to hand, but no activity in the demand. Prices are fairly steady, however, as most makers have little to sell for prompt delivery. We quote spot prices as follows: Caustic ash, 48 per cent, 1d. to 1½d.; high test, 1d. to 1½d. Carbonated ash, 48 per cent, 1d. to 1½d.; high test, 1d. to 1½d. Soda crystals are devoid of animation, and quotations range from £2 8s. 9d. to £2 12s. 6d., according to quantity and brand. Caustic soda still tends downwards, and re-sales of 70 per cent have been made as low as £6 10s., although only in isolated cases, as 1s. 3d. to 2s. 6d. advance on this figure has been paid. A very fair business has been done at these figures, but the second-hand lots are not yet all cleared out.

Makers are less firm, and quote from £6 12s. 6d. to £6 15s. for 70 per cent. Sixty per cent is scarce, and held for £5 15s. to £5 17s. 6d., with business done at the lower figure. Seventy-four per cent we quote £7 3s. 9d. to £7 5s. Seventy-six per cent firm, at £8 10s. Bleaching powder is very flat, and orders being scarce, prices have declined. Nominal quotations are £7 7s. 6d. to £7 10s., while some re-sale parcels have changed hands at a shade under the lower figure. Chlorate of potash is also very dull, and 5 to 5½d. are nearest values for early delivery. Bicarbonate of soda firm, at £4 12s. 6d. to £4 15s. per ton for one cwt. kegs, according to brand and quantity. Sulphate of ammonia has declined to £11 16s. 3d. to £11 17s. 6d. for good gray 24 per cent in single bags, and buyers holding off looking for still lower prices.

**BUILDING MATERIAL MARKET.**

NEW YORK, Friday Evening, March 15.

The project of consolidating the Building Material and the Mechanics and Traders' Exchanges has been settled for a time at least. At a meeting of the members of the former exchange on Tuesday last, out of 215 votes cast, 108 were in favor of and 107 were against consolidation. The result was so close that the matter will probably be dropped for the present. The majority in favor of the scheme is not large enough to warrant any further action.

**Bricks.**—Spring was ushered in several weeks too early for the comfort of the river brickmakers. The opening of the Hudson River last week has produced a weak and unsettled feeling. Out of the four cargoes which arrived last week only three were sold; but with an inexplicable lack of foresight, the makers persisted in loading steadily, and nine barges arrived from Haverstraw on Wednesday, and by this time a much larger number has probably arrived. In the early part of the week receivers stuck to the \$8.00 quotation, but \$7.75 would probably command a very fair quality to-day. Long Islands are at \$8 00.

**Lime** is still scarce and there is little difficulty in selling all arrivals.

From the report of Bureau of Statistics, issued this week, we glean the following interesting facts:

The imports of cement during January, 1889, aggregated 47,394 barrels, against 164,165 barrels in January, 1888. This large decrease in our importations would indicate that the conservative policy which importers profess for this year is being adhered to.

Imports of clays of all kinds in January were slightly in excess of last year at the same time.

Imports of marble and stone during January were valued at \$97,761, against a total valuation of \$59,761 in January, 1888.

Lime and cement were exported during January to the extent of 14,068 barrels, as compared with 4720 barrels during the same period in 1888.

Roofing slate export during January were valued at \$10,548. Exports during the seven months ending January 31st amounted to \$72,781 against \$41,263 for the corresponding period one year ago. This large increase in our exports of slate has occasioned considerable comment. The exports for the calendar year 1888 were nearly twice as large as in 1887, amounting to 4,295,858 pieces from New York alone.

It is a noteworthy fact that the principal demand has come from Australia and New Zealand, these two colonies contributing nearly the entire increase last

year. In view of the ENGINEERING AND MINING JOURNAL's repeated recommendations to our exporters to study these colonial markets, these figures are particularly gratifying.

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Horsford's Acid Phosphate, Useful in all forms of Dyspepsia.

**DIVIDENDS.**

**ASPEN MINING AND SMELTING COMPANY,** No. 54 Wall street, NEW YORK, March 11, 1889. Dividend No. 5 of TWENTY CENTS PER SHARE has this day been declared on the stock of this company (\$20,000 shares), payable at the office of the company on and after the 15th day of March, to stockholders of record. The transfer-books will be closed on Wednesday, March 13th, at three o'clock P.M., and reopened on Monday, March 18th, at nine o'clock A.M. J. L. TILTON, Secretary.

**IRON SILVER MINING COMPANY,** 23 BROAD STREET, NEW YORK, March 11, 1889.

Dividend No. 25, of TWENTY CENTS per share, (\$100,000) will be payable at the office of the Treasurer of the Company, 145 Griswold street, Detroit, Mich., on and after April 2. Transfer-books will be closed March 21, at 3 o'clock P.M., and re-open April 5, 10 o'clock A.M. Checks will be mailed to Stockholders as usual. If any change in address, notify JOHN M. NICOL, Treasurer, 145 Griswold street, Detroit, Mich. HOMER A. HOIT, Assistant Secretary.

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