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ACCORDING to *The Steamship* no less than 21 new vessels have been fitted on the Clyde with quadruple-expansion engines. There is no doubt, it says, that when the present period of great prosperity in marine engineering and shipbuilding has passed, engineers will turn their attention in earnest to this improved form of engine, which will, in all probability, soon be the standard one.

THE opening of the Forth Bridge has been duly celebrated by our London contemporaries, *Engineering and Industries*, by the issue of magnificent special numbers dealing fully with the subject in all its bearings. *Engineering* devotes to this subject 71 pages of reading matter, interspersed with many minor illustrations, which are accompanied by numerous large plates representing the work in all its stages. The enterprise of our contemporary has been well appreciated, as it deserved to be, and before the issue took place, the whole of the edition was sold, and the demand for copies was such that a reprint of the descriptive matter and illustrations was published on special paper, the price of such copies being 5s.

The special number of *Industries* is not less worthy of attention as a magnificent piece of technical journalism. It contains a complete historical description of the Forth Bridge, and more than 120 illustrations, 55 pages being devoted to the interesting topic.

ON another page we record certain facts elicited in the course of an investigation of the merits of the claim by Mr. JOHN HEERDEGEN that by the aid of a scientific instrument, he is enabled to detect the presence of subterranean water. The time devoted to this investigation has been considerable, as is warranted by the importance of the question, one affecting almost every industry in the country; but in the absence of information as to the exact nature of the construction and principles of action of the apparatus or pendulum used, each will form his own judgment.

In our opinion the pendulum is merely an indicator to make evident a personal sensitiveness to the presence of water, and as Mr. HEERDEGEN claims that any one or nearly every one may become expert by practice, it seems that this is a case of the development of nervous sensibility that is present in most persons but is usually unobserved and unknown even to its possessor. Persons in want of water might do well to call in Mr. HEERDEGEN, who is willing to make his fee contingent on his success in finding water. We are indebted to the courtesy of Mr. A. FTELEY, chief engineer of the Croton Aqueduct; of Mr. WILLIAM SAUNDERS, of the Ingersoll-Sergeant Rock Drill Company, and of Mr. SLATER, engineer of the National Storage Company, for the facilities and assistance given to us.

THE American Society of Mechanical Engineers has just taken a most important step in purchasing for its permanent headquarters the building hitherto owned by the New York Academy of Medicine, No. 12 West Thirty-first St. It is a fine four-story building, 28 feet in width, with basement and cellar and an extension in the rear, built for a meeting hall, capable of seating about 150 persons. A gallery around the hall is fitted with shelves for a library. The purchase price was \$60,000, and it is estimated that about \$3,000 will be required for necessary alterations and repairs. A new association has been chartered, known as the Mechanical Engineers' Library Association, which will have charge of the building and of the library. The funds for making the purchase have been partially raised by a mortgage of \$30,000 at four and a half per cent. interest, and the remainder is to be raised by the issue of five per cent. bonds. A number of these have already been subscribed for, and it is expected that in a few days the whole issue will be taken. As the building is larger than is needed at present by the Mechanical Engineers' Society for its own purposes, a portion of it has been leased to the American Institute of Electrical Engineers, and another portion to the Society of Amateur Photographers. It is the intention that the libraries of the Mechanical Engineers and of the Electrical Engineers will be placed together, so that each may be conveniently used by the members of both societies. A financial estimate made by the committee of the council of the society, shows that the annual expenditures, less the receipts for rental, will exceed very little, if at all, those now incurred by the society; and as the society is rapidly increasing in membership, there is no doubt of the new venture being a success financially. It will also be a great convenience to the members and will increase the prestige of the society. The location is an excellent one, within two blocks of the Engineers' Club and of numerous first-class hotels.

A PROVISIONAL list has been received of the members of the Iron and Steel Institute of Great Britain, who expect to attend the meeting to be held in Pittsburg in October of this year, in response to the invitation of the American Institute of Mining Engineers, with the cooperation of the societies of civil and mechanical engineers. The list bears 250 names, among them Sir James Kitson, president of the Institute, Sir Lowthian Bell, Lord Edward Cavendish, Messrs. E. P. Martin, E. Windsor Richards, G. J. Snelus, R. A. Hadfield, John Head, A. Pourcel, E. Riley, Frederick Siemens and many other well-known ironmasters and metallurgists. An invitation has been extended to the Verein Deutsche Eisenhüttenleute, and individually to leading metallurgists and those interested in the iron and steel industries of France, Germany, Austria and Sweden. It is probable, therefore, that as many as 500 guests will be present.

The programme of meetings and excursions has not yet been definitely arranged, but it is expected that there will be a joint meeting of the Iron and Steel Institute and the American Institute of Mining Engineers in Pittsburg, and that, in addition to visits to works in Pittsburg and its vicinity, two excursions will be made, one to Lake Superior and the other to the South. Since so many of our engineers have had personal experience of the magnificent hospitality extended by the British and continental engineers to the three hundred members of the three American societies who visited Europe last summer, it is incumbent upon our societies to show in the arrangements to be made at least equal cordiality in hospitality and skillful engineering management is obvious. There will be no difficulty in insuring for the visitors an enthusiastic welcome by American engineers and metallurgists, but the systematic organization of the meetings, visits to works, excursions and other entertainments will task the utmost powers of the reception committee, and will necessitate liberal support from the pockets of those who do not wish to be ashamed of their country's hospitality.

THE NEWBERRY-VAUTIN GOLD EXTRACTION COMPANY.

THE third annual meeting of the shareholders of the Newberry-Vautin (Patents) Gold Extraction Company, Limited, has just taken place in London, and the tale that they were told by their directors, accompanied by the absolute lack of any satisfactory result after so long a time since the company was brought out with such a flourish of trumpets, was only what might have been expected by any reader of the *ENGINEERING AND MINING JOURNAL* of October 29th, 1887, and subsequently.

The history of the company in brief has been that it was successfully floated in 1887 with a paid up capital of £100,000, and that many people were induced to buy shares at a high premium over this price, the principal asset being valueless patents. The company has received in payment for patent rights sold, £50,000 in fully paid shares of the New Zealand Gold Extraction Company and £50,000 in fully paid shares of the Colorado Gold and Silver Extraction Company, both of which companies have failed completely, and consequently the shares are worthless. In addition to this the company has a claim for £16,000 an abortive Hungarian off-spring, which the directors are bound to admit is apparently of no value. Lastly the company has received the enormous sum of £544 from royalties during the past year, and £10,000 in shares of the South African Metallurgical Company, in commutation in full of all royalties in South Africa, which field, one year ago, was the great hope and stand-by of the parent company. In December, 1888, an interim dividend at the rate of 15 per cent. was paid, and a liberal distribution of the worthless paper shares was made to the shareholders. Now, although the balance sheet shows an amount to the credit of the company of £1,500, a debt of £1,171 is acknowledged by the Chairman.

Wonderful to say, and it is a fine example of the faith and patience of English shareholders with a board of directors once in office, no matter how incompetent, this report was accepted on the threat by the directors that if the report and balance were not approved by the shareholders they would resign. The same directors, therefore, resume their task of trying to make ropes of sand.

As we stated in 1887 the patents are absolutely valueless, and it is a marvel that persons connected with mining could have been found so ignorant of this fact as to pay, in one or in ten years, the sum of £544 in royalties for them.

FOOD ADULTERATION.

A very interesting, if somewhat depressing, publication has just been issued by the Department of Agriculture as bulletin No. 25, entitled "A Popular Treatise on the Extent and Character of Food Adulterations." This report is by Mr. A. J. WEDDERBURN, special agent, and is in line with the work of WILEY, RICHARDSON and others who have carried on investigations of this kind for the Department.

Mr. WEDDERBURN classifies food adulterations under two heads, injurious and non-injurious to health. Adulterations not injurious to health may be subdivided into two classes: Those which are simple debasements of well known dietary articles of which a standard exists by which to test them, such as flour, grain, lard, wine, sugar, etc. The second subdivision includes such articles as yeast powders, beer, patent medicines, etc., and presents special difficulties to the investigator from the lack of any such standard and of any fixed rules to govern the formulas.

The investigations of Mr. WEDDERBURN lead him to conclude that adulteration of food products is generally and steadily increasing. Is he an alarmist? We do not think so. Still, it should be remembered that such apparent increase in food adulteration should in part be attributed rather to the more thorough investigation, both as to scope and minuteness, of late as compared with earlier researches, than to any actual depreciation in the quality of the food products. At all events, let us have the whole truth. Our exporters, especially, cannot afford to have any uncertain cloud hanging over their goods, and it is gratifying to know that many of the prominent houses (and more particularly those exporting canned goods) have put forth special effort to purge the trade of sophistication. It may be remarked here that the samples taken for inspection are generally obtained from small dealers in the open retail market, and hence by no means indicate the character of the original goods in first hands. This is a point which the official reports do not dwell upon, but it is a most important one in its bearing on the export trade. It is a matter of common knowledge that standard brands, in the original packages, are not fairly represented by the goods offered by irresponsible retailers. But in statistics of adulteration this fact is masked.

Most of the food adulterations, we are told, belong to the second class, namely, the non-injurious to health. This is a cause for congratulation, and in many cases of adulteration prejudicial to health the use of such adulterants ought to be charged rather to ignorance than to malice. The result to the consumer, however, is just as grievous, and calls as loudly for his protection from deleterious compounds fraudulently introduced into food, drink, and drugs as though he were the victim of malice.

Setting aside the consideration of the poisonous class of adulterants, by

which the public health is injured, Mr. WEDDERBURN finds that what he terms non-injurious adulteration, is so common, that estimates as to the amount of which the American people are annually defrauded in this manner, are simply appalling. This loss bears most heavily upon the poor and ignorant, who buy the cheapest supplies, with little regard to quality. Adulteration also lessens the profits of the farmers, and by giving a bad name to certain kinds of food products, tends to restrict our export trade. Notwithstanding the legislation and systems of official inspection which have been put in force in most of the States, the evil is far from being suppressed, the ingenuity of the sophisticators keeping pace with the general inventive progress of the times. What the state of things would be without legal restriction is difficult to imagine.

Some striking estimates of the actual cost of adulteration are cited by Mr. WEDDERBURN. For example:

"The total value of the yearly food supply consumed in the United States, according to the *American Grocer*, is, at a low estimate, \$4,500,000,000. The *Grocer* estimates that two per cent. of this is adulterated, or \$90,000,000, of which 90 per cent. is of a character non-prejudicial to health (this is exclusive of meats and milk). Accept for the sake of argument this statement, and the result shows that there is \$9,000,000 worth of poisonous food products put annually on the country, and \$81,000,000 of fraudulent products. That this estimate is far below the truth none can doubt for a moment, after an examination of the very able reports made in those States that have attempted to protect their citizens against adulteration. Take the very conservative estimate of Dr. Abbott, of Massachusetts, of a saving of five per cent. to the people in the increased purity of food products (to say nothing of the benefit to health and morals). On \$4,500,000,000 the annual saving to the country would be the immense sum of \$225,000,000. There is undoubtedly a large part of the food products that never leaves the hand of the producer, and, of course, this is not adulterated; and again, the wheat and corn production is rarely found adulterated in this country, besides which there are, of course, many articles manipulated and sold by honest men who would disdain to sell their goods if debased or misbranded. Yet, in spite of all this, undoubtedly, the percentage of adulteration, sophistication and misbranding, largely exceeds," in Mr. Wedderburn's opinion, "five per cent. of the whole," and he is confident that 15 per cent. would be much nearer the mark. Such an estimate would give the startling figures of loss to the people of this country alone of \$675,000,000 a year.

But while the adulteration of food is so extensive, it is far better to have the whole truth known, that the nuisance may be abated, as it undoubtedly can be. Then, too, it is some small consolation to reflect that the bad showing made is largely due to the vigorous investigations made in this country, and that similarly searching inquiry would doubtless reveal a worse state of things elsewhere.

There are some convincing examples of what can be done by judicious legislation and inspection. The South Carolina phosphates are now so standardized that the buyer knows what he is getting—about what percentage of available phosphoric acid, etc. In Michigan the grades of salt are legally fixed, and false branding is practically impossible. Such restrictions are to the advantage of the producers quite as much as to the consumers, for in the long run dishonesty never pays. Buyers will always be shy of the whole class of products in which perhaps only a very small portion had been adulterated or falsely marked. It is therefore to the interest of the whole producing community to protect the good name of its products. We have also seen how much good can be done by stringent application of flash tests for illuminating oils. Further examples could be readily found.

The matter is one for State supervision. Already local health boards, acting under State laws, have done much to protect citizens in their purchase of milk, butter, meats, etc. Unquestionably this could be done for the export trade as well, in which case of course inspectors would obtain their test samples from producers and wholesale dealers rather than from the retail trade, and standards equivalent to the South Carolina phosphates and the Michigan salt, just referred to, could be maintained. Legislation of this kind requires careful consideration, but it assuredly is practicable.

THE FRIENDS AND ENEMIES OF PROTECTION.

What are the objects of the system of protection to American industries, and who are its friends and who its enemies? These questions are extremely important at present, and upon their answer depends to a great extent the perpetuation of the system of protection. Up to very recent years protectionists of all schools claimed that the object of this policy or system was to compensate those who invest in the establishment of new industries for the disadvantages of want of experience and insufficient capital, and thus enable them to compete with the older manufacturers in the same of other countries line on equal, or nearly equal, terms. The idea being that it is desirable to promote the diversity of manufacturing interests in a young country, and to offer such inducements for the investment of capital in new industries as will permit their establishment and to protect them from ruinous competition while they are taking root, and while those engaged in them are gaining that skill and experience which are necessary to secure economical production and distribution of products. It never was pretended that an industry which has none of the elements of success should be maintained forever at the expense of the public, but only that such industries as possess in the natural conditions of the country a foundation for ultimate success should be fostered until they have utilized or

developed conditions which will enable them to compete with the manufacturers of other countries. Unfortunately, the taste for protection grows with what it feeds on, and those who are thus enabled to make large profits are not only unwilling to relinquish any part of the advantages which protection gives them, but the stronger they become financially, and the better able they are to compete without public support the better able they are also to influence legislation in their own behalf and to perpetuate the bonus which the taxpayers of the country were willing to contribute for the establishment of their business.

The limitless expenditures of the war rendered necessary the imposition of high taxes in the form of tariff, both as a source of revenue and to compensate for high cost of manufacture; but this high cost long ago ceased, and the profits of the manufacturers have, in many instances, become enormous, and the time long ago arrived for reducing taxation in this direction. Nearly every administration, whether Republican or Democratic, since the war has advocated the revision of the tariff and the reduction of its war rates to more moderate figures; but now the favored ones appear to have abandoned all the old arguments for protection and seem to claim that this is a perpetual system, and that tariffs should be maintained always to the point where they will prevent any competition whatever from the outside, no matter what the cost of producing at home may be. Since some of the most important of our industries are not protected, it is natural that opposition would come from these; and it is now very evident that this opposition is increasing and threatens, unless reasonable ground for it be taken away, to grow soon to such proportions as to reverse the policy altogether and bring about a period of extremely low tariffs. It seems, therefore, to those who, like the ENGINEERING AND MINING JOURNAL, favor a moderate protection where necessary for the establishment of new industries to see to it that the system be not endangered by the abuses of those who do not need protection, but who insist upon retaining it in order to swell already large profits or to compensate them for extravagance in manufacturing. It should be the aim of protectionists to so reduce tariff bounties that the protected industries would gradually be prepared for competition without public help and adapt themselves to the conditions which must then exist. So soon as an industry has attained the position where it can more than supply our home market and has to send its goods abroad, where they compete with those of foreign manufacturers, it is evident that they are either giving the foreigners the benefit of lower rates than they do our own people, or that they are able to get along at home without any protection from foreign manufacturers. It is not fair that our own people should be made to pay more than foreigners for the products of our own land; nor was it ever designed that the tariff laws should effect this—but the demands of the ultra-protectionists are not governed by logical arguments, and at the present moment there seems to be a disposition in some quarters to grab all possible from the public treasury, regardless of the ultimate effect upon the system. Many of our ablest public men and sincere protectionists recognize the danger of this policy, and are privately raising their voices in warning.

The New England iron manufacturers have petitioned for free coal and iron ore, and for a reduction of duty on scrap iron. We do not think the New England natural conditions, even with free coal and iron ore, are favorable to the establishment of successful pig iron production in competition with more favored districts in Pennsylvania, New Jersey, Virginia, Alabama, etc.; but the objection raised to taking off the duty of 75 cents a ton from iron ore and coal is that these minerals are produced more economically in Canada than here, because of cheaper labor.

This statement is absolutely erroneous. From personal knowledge we can state that the cost of putting coal on the cars at the largest coal mine in Nova Scotia is about \$1.20 a ton, or about twice the cost in the Cumberland region, Maryland, and more than twice the cost at the Pocahontas coal mines, West Virginia, or at Connellsville, Pa., or at one mine, at least on the New River, West Virginia. We can also state positively that there is not an iron ore mine in Canada that can produce its ore as cheaply as this is done at several of the large mines in the Lake Superior region or in the Champlain district of New York. There is not a mine in Canada in which the miners are not paid higher wages than are being paid in New York State, in New Jersey, and in many parts of Pennsylvania, Virginia, and even on Lake Superior. There is, in fact, nothing necessary to manufacturing or to the production of minerals which cannot be procured at less cost in this country than in Canada; therefore, competition from Canada is out of the question, except in a very few districts where the Canadian mines are close to expensive American markets. American capitalists have invested large amounts of money in Canadian iron, copper, and nickel mines. They have rarely made a profit on their investments.

Americans own the copper-nickel mines in Canada and desire to bring the ores into this country for economical treatment. This would build up an important industry here; but we have for many years imposed a tariff of 15 cents a pound on nickel for the special benefit of one individual, whose mine has now ceased to produce, and yet this much-favored gentleman still calls loudly for the retention of this duty, which prevents the establishment of a great American industry. The extension of the use of nickel

necessitates a reduction in its cost, and this reduction can scarcely be obtained here while the metal has to pay 15 cents entrance duty, and the best known deposits of the ore, those in Canada, are owned by American citizens. This is but one example of what we consider an injury and danger to the protective system. It is very evident to those who study the signs of the times that a storm is brewing which threatens the very existence of the protective system unless the demands of its advocates be moderated, and we, as advocates of a moderate and necessary protection for young industries, raise our voice in warning to those who are endeavoring to render the whole system obnoxious by its abuse.

The enemies of protection are those who build up a dam higher and higher to hold back the rising flood which eventually will burst all obstructions and sweep away those industries that, with moderate protection, would grow to possess permanent stability, but which under the sudden open competition which a removal of all duties would involve would certainly be destroyed before they could adapt themselves to the new conditions of existence.

The friends of protection are those who would show such moderation in its demands as will prevent this opposition from becoming a dangerous or destructive torrent.

NEW PUBLICATIONS.

BULLETINS OF THE UNITED STATES GEOLOGICAL SURVEY, Nos. 48-53. Printed by the Government Printing Office, Washington, 1889. Paper, 8vo.

No. 48. *On the Form and Position of the Sea Level.* By R. S. Woodward (88 pp.; price 10 cents).—The discussion is with special reference to the dependence of the sea level on spherical masses systematically disposed about a normal to the earth's surface. The questions treated are, for the most part, necessarily mathematical. They are, however, as the author justly says, fundamental questions in geophysics; and, although he has followed the mathematical form of presentation throughout, an attempt has been made to state the end results and formulas in such a way that they may be understood and used by those who may not care to follow the details of the analysis.

No. 49. *Latitudes and Longitudes of certain points in Missouri, Kansas, and New Mexico.* By R. S. Woodward (133 pp.; price 15 cents).—This is a report, mainly in tables, on the determination of astronomic positions in the area named.

No. 50. *Formulas and Tables to Facilitate the Use of Maps.* By R. S. Woodward (124 pp.; price 15 cents). Manuscript copies of these tables were prepared for the use of the division of geography of the survey in 1885-6, since when they have been constantly employed, and are now printed as a bulletin, with revisions, extensions, and explanatory text.

No. 51. *On Invertebrate Fossils of the Pacific Coast.* By Dr. C. A. White (102 pp., 14 plates; price 15 cents).—Dr. White has made an addition of a number of new species, and one genus of the Chico-Tejon series of California. The existence of new localities of strata referable to that series is announced for Oregon and Washington. The fauna of the Vancouver group is discussed, with three new species; and a small unique fauna from the coal-bearing formations of the Puget Sound Basin is described. The lithographic illustrations are very handsome.

No. 52. *Subaërial Decay of Rocks, and Origin of the Color of Certain Formations.* By I. C. Russell (65 pp.; 5 pl.; price, 10 cents).—Mr. Russell describes the large areas of surface material in the Southern Appalachian region, resulting from subaërial decay, and often from 15 to 20 feet in thickness, occasionally as much as 50 feet. This superficial deposit he considers to be the result of disintegration, with little evidence of chemical decomposition. His especial study, however, has been in regard to the red sandstone of the Newark system in the Southern States, and in Part II. he presents an interesting discussion as to the origin of the color. Every one knows that this red color is due to the presence of ferric oxide; but, as Mr. Russell shows from his own observations and numerous citations from geological authorities, the subject cannot be dismissed with the bald statement that the red oxide is the result of the decomposition of iron-bearing minerals (pyrites, magnetite, hornblende, augite, etc.) originally present in the parent rock and subsequently peroxidized. There are a number of series of possible chemical reactions, some of them complicated, by which the final result may be brought about. The leading hypotheses are: A set of reactions having iron protochloride or carbonate as a middle term; or a reddening from the heat of metamorphism (like the peroxidation in brick burning), caused either by orographic movement or by the injection of eruptive rock. A great deal has been written heretofore on the subject, and many ingenious suggestions have been made. No one hypothesis will account for the whole range of observed facts, for the possible conditions under which the elastic rocks were laid down are so numerous and involved that the problem is an intricate one. For example, regarding certain sandstones it has been a question as to whether the red cement of ferric oxide is a chemical precipitate or a mechanical incrustation; and, if the latter, whether it was formed simultaneously with the deposition of the quartz grains or was a subsequent infiltration. Mr. Russell, in order to verify the conclusions of previous observers, made a microscopical examination of many thin sections of the Newark sandstone from various localities. All of the specimens were composed principally of angular quartz grains, with which were frequently mingled fragments of feldspar, hornblende, mica, etc. In some examples the rocks were gray, and derived their color from the inherent tints of the fragments composing them. In most instances, however, they had the characteristic brownish red color, and under the microscope showed that their color was not inherent in the particles but was due to a fine, amorphous, clay-like coating which enveloped the grains and filled the intervening spaces. The edges of the quartz grains are sharply defined by a red line. The coloring matter is not in concentric layers and not crystalline, which fact the author takes to indicate that it was not deposited from solution. He considers it to be the fine reddish sediment

(residual clay, which obtained its color at the time of disintegration and before settling) deposited with the quartz, with perhaps some infiltration afterward, but not to any extent. The difficulty which here meets the hypothesis is to explain how the comparatively large and uniform quartz grains and the fine mud should be deposited so regularly together over large areas, with no intermediate sizes. This is something opposed to our ideas of natural sedimentation and against all rules of concentration. Mr. Russell maintains his position with considerable force, but space does not permit quoting his argument in detail. The subject is an interesting one, apart from other reasons, because of its bearing on the origin of iron ore deposits, and we therefore quote the author's résumé:

"The formation of red deposits from the débris of rocks that are not red, but contain iron in the hornblende, mica, chlorite, magnetite, garnets, pyrites, and other minerals of which they are composed, evidently necessitates that the minerals holding the iron should be decomposed and the iron oxidized. This process we now find in operation over large portions of the earth's surface in the formation of residual deposits, of which the terra rossa of Europe, the laterite of India, the red earth of Bermuda and the residual clays of the southern Appalachian region are the best known examples. The residual deposits resulting from the subaerial decay of crystalline rocks agree both in chemical composition and in the manner in which the grains of sand are incrustated with ferric oxide, with the sandstones of the Newark system, and with other formations of a similar lithological character. Moreover, the residual deposits of the Southern States are assorted and deposited by streams without losing the ferric oxide which incrusts the grains, thus showing that they are capable of forming iron-stained sandstones and shales.

"The hypothesis advanced in view of these facts is, that the sands forming the sandstones of the Newark system and other similar formations received their incrustations of ferric oxide during the subaerial decay of the rock from which they were derived."

Mr. Russell is not alone in this hypothesis, as will be seen by his naive statement that "v. Richthofen's view of the possible origin of red deposit agrees substantially with the hypothesis [Mr. Russell's] here presented."

A bibliography of publications on the subject accompanies the bulletin. No. 53. *The Geology of Nantucket*. By N. S. Shaler (55 pp.; 10 plates; price 10 cents).—Professor Shaler, in the course of his general study of the Atlantic coast line, has given attention to the structural features of the island of Nantucket, the results of which are presented separately in this bulletin. The sections and views given in the illustrations are interesting as showing the results of wave action in determining topographical outlines, and the author's deductions are applicable in the case of many similar fields of shore study. On the face, Nantucket would not seem to be a very fertile or exciting field for the geologist; but Professor Shaler, who knows how to make the best of the most unpromising subjects, presents in his usual and taking style a very interesting account of his observations—and we have no doubt that he had an equally agreeable time in making them, for Nantucket has other inducements than those of a purely geological nature. Seriously, however, observations of what is actually going on in shore making and wave erosion are of great importance in determining problems of the past, and the investigation of quaternary, recent and present changes, so long neglected but now claiming a fair share of attention, cannot fail to be productive of useful knowledge as to the history of earlier formations.

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 Salt Union and Brunner, Mond & Co.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: On page 281, March 8, 1890, second article, you refer to trusts. What the salt syndicate has to do with another firm who make their dividends by making soda ash, I can not see; Brunner, Mond & Co. make no salt except for use in making soda ash. It is a good deal like the question: if the price of shad is five cents what will be the price of herring.

March 11, 1890.

[Not at all so obscure. The trust raised the price of salt to manufacturers, so that those like Brunner, Mond & Co., who controlled their own salt supply, made 30 per cent., and the syndicate, which it was claimed would make economies in management by consolidating the industry and be able to make large (20 per cent.) dividends without increasing cost, not only largely increased cost, as shown by Brunner, Mond & Co.'s dividends, but increased their own cost of doing business over that of the independent concerns. The salt trust has been an injury to the English trade and has benefited only those who remained out of it, especially the German salt miners and chemical manufacturers.—EDITOR ENGINEERING AND MINING JOURNAL.]

Mineral Resources of Joplin, Mo.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: Without entering into any detailed criticism of an article on the mineral resources of Joplin, Mo., in the last number of the ENGINEERING AND MINING JOURNAL, I wish to call your attention to what is probably a blunder on the part of your correspondent concerning the assays of the ores of this region.

As quoted, they range from 45 per cent. to 62½ per cent. of "pure zinc blende," that is, from 30.15 per cent. to 41.87 per cent. of metallic zinc.

Plainly, the results were given in metallic zinc, and if so, they would not be far wrong. Ores containing less than 45 per cent. metallic zinc would be almost unsaleable here at the present time, unless they were calamine.

Joplin was the pioneer camp in this district, and it is in a certain sense allowable to speak of the district as the Joplin region, but to lay three counties and two states under contribution, and report their production as ore shipped from Joplin, and the product of the Joplin mines, is certainly misleading. The following is a statement of the output of the Center Creek Mining Company, at Webb City, which was prepared for an-

other purpose. It will at least show what a single Webb City company has done and is doing.

The mines of the Center Creek Mining Company at Webb City, Mo., have a recorded production of 150,000 tons of zinc ore, and 11,000 tons of high grade lead ore, and recorded sales amounting to more than \$3,100,000.

The Center Creek Mining Company was organized on the 22d day of March, 1889, with a capital of \$1,000,000. It has an office in Kansas City, and much of its stock is held there.

In the eleven months ending February 22d, 1890, during which the company has been in existence, these mines have produced 18,908 tons of zinc ore, which has been sold for \$453,325, and 981 tons of lead ore sold for \$43,670, making a total of \$496,995 for eleven months' work.

Some idea may be formed of the extent to which these mines are opened, and of the reserves of ore which they contain above water level, from the production of the week ending Feb. 22d, 1890. During that week, notwithstanding the many inconveniences and serious difficulties incidental to mining in winter, they produced and marketed 770 tons of zinc ore and 23½ tons of lead ore, a week's output of the aggregate value of \$18,500.00.

WEBB CITY, Mo., March 10, 1890.

J. L. CLERC.

High Speed in Ocean Steamers.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: I was much interested in reading Mr. Schieldrap's excellent contribution on high speed in ocean steamers, in the ENGINEERING AND MINING JOURNAL of the 1st instant. His paper is a noteworthy addition to the literature on the subject, is conservative in tone, and was evidently thoughtfully considered. In the main, the author is in full accord with the best modern authorities. Yet this is one of those intricate subjects concerning which no two persons can be found to agree perfectly in all details. There are an endless number of components in the problem, which may be put together in an infinity of ways and proportions; and thus far, notwithstanding the close attention bestowed, the great amount of experimenting on both the large and the small scale, and the application of mathematical analysis, no one has succeeded in demonstrating what are the absolutely best lines for any particular type of vessel—to say nothing of that far simpler yet elusive point, the form of least resistance. This latter is only one of the considerations to be taken into account in designing a high speed ocean steamer, and it would seem that if attention were concentrated upon it alone, to the exclusion of the many other elements, some definite result ought to have been reached, experimentally if not theoretically, long ago. But, as a matter of fact, it has not.

All will concur in Mr. Schieldrap's main propositions: that speed depends on the proportion between power and resistance, and that while the former has been developed to a high point latterly, the reduction of the latter (which, by altering the proportion, would increase the speed just as well as increasing the former) has not received equal or due attention; that saving of weight is of the utmost importance; and, hence, that for excessive speed ocean vessels should be specialized, that is, designed for carrying passengers, baggage and mails only, not cargo. These three propositions are unanswerable.

But when we consider the first point—the reduction of resistance, or in other words the obtaining of the "form of least resistance," there is room for argument. As I understand Mr. Schieldrap, he inclines to the "wave" theory of Russel and Froude, and to secure the lowest coefficient of fineness (percentage between the vessel's displacement and a paralleloped described by a vessel's length, beam and draft) would follow Mr. Froude in saying that for high speed a parallel middle body is not admissible, but the whole length should be taken up by entrance and run. This system, if the longitudinal lines are not very much softened near the midship section, results in forming a projecting shoulder there, which it does not require demonstration to perceive must be disadvantageous. Mr. Schieldrap instances the modern American center-board yacht as an example of extremely low coefficient of fineness. But here the conditions are very different from those of a steamer; it is a question of getting the most sail-carrying power on the lightest displacement, as well as the mere selection of the best form for transit through the water.

Let us eliminate so far as possible everything which complicates the inquiry, and consider for the moment only what the designer could do if he were called upon to lay off an ideal high-speed ocean steamer. He would not have to provide for sail power, for the ideal steamer would be mastless, and, therefore, would not have to give more beam than his form of least resistance demanded, nor deep ballast to make the vessel stand up to the wind pressure. The lines could, therefore, be made as fine as desired, and the draft would be light and unnecessary weight avoided. He would need no keel or deep forefoot for wind-jamming, since there would be no sails. Nor need he add bilge keels or modify his midship section for the sake of steadiness, since sea-sickness need not be considered an element of an engineering problem, and his vessel might roll as much as she pleased. He would, therefore, select a sub-circular mid-section as offering the smallest area of wetted surface for given contents. He need not provide buoyancy to lift the bows to the seas, but would plan to go through them, with turtle-back protection, and, besides, the ideal condition for speed is smooth water. As the vessel would carry no cargo, her displacement would be small in proportion to her power, and this again means lightness and a low coefficient of fineness. The length might be extended without regard to wave-crest distances, and also without regard to handiness and turning power, for the vessel, once pulled and pushed by tugs out of her berth and out of port would have a straight course ahead to her destination, where other tugs would take her in hand, and safely conduct her to her new berth. There would be no dead weight but coal, and the insignificant weights of passengers, crew, luggage, etc.; all carrying capacity would be virtually given up to power. As the coal is consumed, water ballast would regulate the trim. There would be none of the constructive difficulties which limited the form of the old wooden ships, for with modern steel and manganese bronze and other alloys, and the adoption of the truss and plate girder systems, the designer is left free to choose his dimensions and proportions, so far as material is concerned. Finally, for the sake of

making the case complete, let us assume that neither economy in construction nor economy in running are to be taken into account, and it is also assumed that the best fuel and machinery, the strongest and lightest material and the smoothest skin are at command.

Now, given all these ideally favorable conditions and freedom from restraint, what could the naval architect do, in planning this suppositious high-speed passenger steamship?

Very fortunately, this very problem has been worked out experimentally on the small scale, condition for condition, point for point, so that without theorizing or further experiment one has at hand the very counterpart of the ideal high-speed steamship for study and imitation. That model is the racing shell. Here the conditions are reproduced as exactly as possible; no dead weight, small restrictions as to stiffness and turning power, and the choice of material. What then is the form of the racing shell? Here is a case where speed is practically the sole aim, and one in which long and extensive experience has been had.

The lines of a racing shell are of course excessively fine. But they are not hollow, and while there is not a very long parallel mid-body, still there is one, notwithstanding Mr. Froude, though its shoulders are so fined away as to be almost imperceptible. And the proportion of beam to length is far smaller than in any steamer. If 11 to 1 is an extreme of steamship fineness, it is not to be compared with the 20 to 1, and sometimes 30 to 1, of the shell. And yet with this excessive leanness it is altogether probable that skin friction has not equalled cross-section resistance, though according to some recent naval theoretical writers, it should do so,

proximations only can be looked for, even if the present craze for excessive speed at any cost shall warrant revolutionary changes of model.

NEW YORK, March 12, 1890.

ALBERT WILLIAMS, JR.

WILLIAM JARVIS McALPINE.

William Jarvis McAlpine was born in New York City, April 30th, 1812, and was of Scotch descent, his grandfather having served as an officer of the British army prior to and during the Revolution in this country. John McAlpine, his father, was a prominent mechanical engineer and millwright, and while in the employ of the Delaware and Hudson Canal Company had charge of the construction of the inclined planes and machinery of that company at Carbondale, Pa. The father, intending that the son should succeed him in the profession, gave him the best training then attainable in the schools, where he received instruction in surveying and engineering as taught at the time.

Mr. McAlpine began active work at the age of 16, as rodman for the Delaware and Hudson Canal Company, in which service he experienced the usual discomforts of the young engineer in "roughing it." From this time on, during a career of 63 years of nearly constant activity, he was employed in important undertakings of a wide range of character, and he speedily rose to the front rank of American civil engineers. It is impossible to attempt a description of even the most striking of his achievements, or a mere enumeration of the various works with which



Wm McAlpine

Builders of shells, knowingly or unconsciously, base their designs upon the theory which was held before the "wave" theory became popular (namely, that resistance was made up of the two simple components of cross-sectional resistance and skin friction), and reduced the midship section to the utmost. If it had been found that diminishing the beam and increasing the length led to an increase of skin friction beyond the point where it equalled the cross-sectional resistance, they would have stopped reducing beam at that point to keep the two resistances equal. Again, it is found in practice (just as with steamships) that lengthening out the parallel middle body of shells does not increase resistance in proportion to the gain in additional power which can be carried, as is shown by comparing the speed of four-oar, six-oar and eight-oar boats. This illustrates the familiarly recognized fact that, other things being in proportion, size is a factor of speed, as is also shown with all classes of craft.

It is true that latterly there has been a recession from the extreme designs (11 to 1) of the ocean steamers of a few years ago, and that a length of nine beams is about the present rule; but this change has not been for the sake of obtaining the desired "form of least resistance," but for other reasons. Meanwhile engine efficiency has taken immense strides. High initial steam pressure (160 pounds and more per inch), steel boilers, triple and quadruple expansion, twin screws and improved forms of screw—all these have had more to do with the increase in speed than any new light upon the vexed question of form of hull.

The ideal fast passenger vessel, then, would be something like a big torpedo boat, built on the lines of the racing shell. But in actual practice there are too many modifying conditions involved to permit of attaining this ideal perfection, and, as in other similar mechanical problems, ap-

proximations only can be looked for, even if the present craze for excessive speed at any cost shall warrant revolutionary changes of model.

Mr. McAlpine was connected in various capacities, at first in subordinate positions, soon afterward in places of responsibility as superintendent of sections, then in full charge of enterprises of great magnitude, and toward the close of his life as consulting engineer to large corporations and municipal and government works. Among his labors the following imperfect list may be given to show in some faint degree the versatility and energy of the man: In 1830-31, Mr. McAlpine was with the Mohawk and Hudson River Railroad; in 1832, he served as assistant engineer on the St. Lawrence improvement in Canada; in 1833-34 he was resident engineer on the Chenango Canal; from 1835 to 1845, he was in charge of surveys and works for the enlargement of the Erie Canal, of the eastern division of which he became superintendent in 1849. His long experience with this class of works made Mr. McAlpine an authority upon earthen dam and reservoir construction, about which he presented many valuable contributions to the profession, one of the latest in his life being a report on the Johnstown disaster and the Conemaugh dam. Probably the work which gave Mr. McAlpine his highest reputation, was his skillful construction of the great stone dock at the Brooklyn Navy Yard, an undertaking of the utmost difficulty, owing to the great depth the underlying quicksands and the presence of numerous springs in the subsoil. In this connection it may be remarked that the pumps designed by him for this dock in 1850 are still doing good service. In 1850 Mr. McAlpine prepared plans for supplying the city of Albany with water from the Patroon's Creek, and in 1851 these works were constructed, with Mr. McAlpine as Engineer. In the next year he reported upon a water supply system for Chicago, taking the water from the lake, and under his superintendency the works were completed in 1854, and were in use until, in 1864, the

rapid growth of the city led to the construction of the first lake tunnel. In 1861 he was Chief Engineer of the Brooklyn Water Works. He was elected State Engineer of New York in 1862, and his official reports, dealing with the theoretical and actual costs of transportation by land and water, and interior transportation, are still regarded as standard both in this country and in Europe. In 1864-65 he was a railroad commissioner for the State of New York. He was also for a time engineer and assistant president of the Erie Railway and chief engineer and vice-president of the Galena & Chicago Railroad. In 1867 he reported the improvement of the harbor of Montreal and enlargement of the Welland Canal locks, and the work recommended was subsequently accomplished. He was chief engineer of the Third avenue bridge over the Harlem, and successfully put in practice the then novel system of iron cylinder piles sunk by the pneumatic process. In 1861-'63 he was chief engineer and vice-president of the Ohio & Mississippi Railroad, and in 1864-'65 engineer-in-chief of a Pacific railroad project. In 1865 he designed the water-works and pumping machinery for New Bedford, Mass., the 6,000,000 gallon pumping engine being, it is said, still in service. In 1868 he began his connection with the Arcade railway project for the city of New York, and was still interested in it up to the time of his death. Among the numerous later labors undertaken by Mr. McAlpine were water-works projects for Oswego, Burlington, Schenectady, Norfolk, Hartford, Philadelphia, Rochester, Troy, San Francisco, Danbury, Lynn, Staten Island, Saratoga, Montreal, Toronto and other places, drainage of Baltimore, etc. In 1870 the Austrian government selected him as a commissioner in connection with the improvement works on the Danube. He acted as consulting engineer for the Canada Southern Railway. In 1881 he was consulting engineer for the Tehuantepec Inter-Ocean Railroad scheme, and in 1882 he first reported upon the Ramapo River water supply for the lower part of New York City.

Notwithstanding these constant active occupations Mr. McAlpine found time for the preparation of very many important technical contributions, which always received the most careful attention of the profession. He was connected with a number of the leading American and foreign engineering societies, as active or honorary member, and his reputation was truly cosmopolitan.

The key to his successful career, as stated by a recent biographer, is to be found in the motto which Mr. McAlpine himself, in a notable address, ascribed to the pioneers of American engineering—"integrity, industry, enthusiasm"—in which motto the biographer remarks, Mr. McAlpine purposely and wisely did not include genius, which is confined to few, and seldom, even among those few who possess it, leads to high rank in the engineering profession. We are indebted to *Engineering News* for the accompanying portrait which we have reproduced from last week's number.

PROFESSIONAL WATER FINDING.

In the month of December last we were requested by Messrs. Heerdegen & Schnee to make an investigation of the claim of the former gentleman as to his ability by means of an instrument he had invented to discover subterranean water. This gentleman is an electro-technical engineer, as it is termed in Germany, Bavarian by birth but recently residing in Russia, and it was when there that he accidentally made the discovery of the principle of his apparatus. He brings with him a record of the most complete success attending his efforts in Russia, and the certificates to this effect and the recommendations from houses of the highest standing in Moscow and elsewhere, leave no doubt (as to a genuine) belief there in his powers or those of his instrument.

We have endeavored to test the accuracy of the claim, but from the outset we were confronted by two obstacles in the way of arriving at perfectly conclusive results. Throughout the test we have had the advantage of the co-operation of the *Engineering News*, Mr. A. M. Wellington or Mr. M. N. Baker being present at all of them.

The first difficulty in the way of making an exhaustive investigation lies in the fact that the instrument is not patented and that, therefore, Mr. Heerdegen declined to give us details of its construction, and although we were allowed to see and to handle it and even to try its operation ourselves, we were unable to follow the principles that govern its actions.

The other difficulty to be contended with was, that Mr. Heerdegen's claim is to be able to locate underground springs or streams under natural conditions, and it is evident that the only method of testing this conclusively would be to select a site where there was no knowledge or presupposition of subterranean water supply, and in case of a well being located, to sink to more than the depth indicated by Mr. Heerdegen.

Mr. Heerdegen was, however, willing to waive these natural conditions in their strictness, believing that the instrument would enable him to locate running water equally well in iron pipes or in brick or in masonry conduits, and on this supposition the trials were carried out.

The first tests were made on the line of the new aqueduct in the neighborhood of Sing Sing, the points being selected by Mr. Chas. N. Gowen, Division Engineer, who was also present at the trial. The aqueduct being here far below the surface, and no shafts being visible from the points selected, there is no possible clue to its location, especially to a stranger, and yet at two of the three points a large body of flowing water was located with wonderful exactitude as to the position though inexact as to depth. It is only fair to state that the day was most unfavorable, being the very reverse of what Mr. Heerdegen stated as a prerequisite for accuracy. The second tests were upon the old aqueduct in New York, and they resulted in an accurate determination in one case, and slightly inaccurate in the other, and here again the difficulty of getting a satisfactory artificially arranged test was apparent, as we discovered on making inquiries of the city Water Department that the rock surrounding the aqueduct at this doubtful point was full of springs, which may have had a stronger influence upon the operation than the artificially conveyed water in the conduit.

The foregoing tests were followed by an experiment rather than a test, which consisted in laying about 150 feet of $\frac{1}{4}$ inch steam hose on the second floor of the Raub Building, at the corner of Nassau and Fulton streets, Mr. Heerdegen being stationed upon the third floor before the hose was uncoiled. This hose was passed in through various rooms, a stream of water being sent through it, and Mr. Heerdegen succeeded fairly well in tracing upon the floor above its general direction and course.

The last test at which we were present, was the most satisfactory and

conclusive in every way, the elements of uncertainty being eliminated as far as possible, the locality selected being outside the gate of the National Storage Company, near Communipaw, where the supply of water under pressure to these premises is large and entirely removed from all other pipes, drains, etc., and of course without any indication of its location. This pipe Mr. Heerdegen located with wonderful accuracy and without hesitation, tracing it so nearly correctly that the engineer, Mr. Slater, who had laid it some years previously, and who was present, stated that it was substantially correct. This case was one in which, if Mr. Heerdegen had found it at first only by chance or by a shrewd guess, it would have been impossible for him to have repeated that guess successively three times.

During the occurrence of these tests, fortunately, the opportunity was given to test Mr. Heerdegen practically as a well finder. Mr. Adolph G. Huffel, the brewer at 161st street and Third avenue, New York, desired to have a well located at his brewery, where he had already drilled to the depth of 1,300 feet without finding water. As related by Mr. Huffel, "Mr. Heerdegen went over the ground in the neighborhood of the brewery with his instrument, and discovered water on the west side of our property, and expressed his belief that water would be found within 30 or 40 feet of the surface in considerable quantities, and that the stream was 20 inches wide. Mr. Heerdegen traced the stream for about 1,000 yards, and pointed out in this distance four places where the same stream could be struck. Having selected the place most convenient to us, we commenced boring, and at a depth of 31 feet struck the stream. The water rose to within 10 feet of the surface, and a pump having been introduced, the well yielded 50 gallons per minute for 120 hours without cessation."

We have satisfied ourselves of the correctness of these facts and of the quantity of water given by the well.

THE FORTH BRIDGE.

From the general view of the bridge in profile it will be seen that it consists of two approach viaducts and of the cantilever bridge proper. The viaducts only differ in extent; the height above water and the length of the spans being the same. It will also be seen that a similar viaduct which forms the railroad or permanent way is carried through the cantilevers and central towers at one uniform level.

Commencing at the south end, there are four granite masonry arches which terminate in the abutment for the South Approach Viaduct. Here the girder-spans commence—10 in number—the end of the last being supported in the south cantilever end pier. On the north shore there are three similar masonry arches, terminating in an abutment, and five girder-spans to the north cantilever end pier.

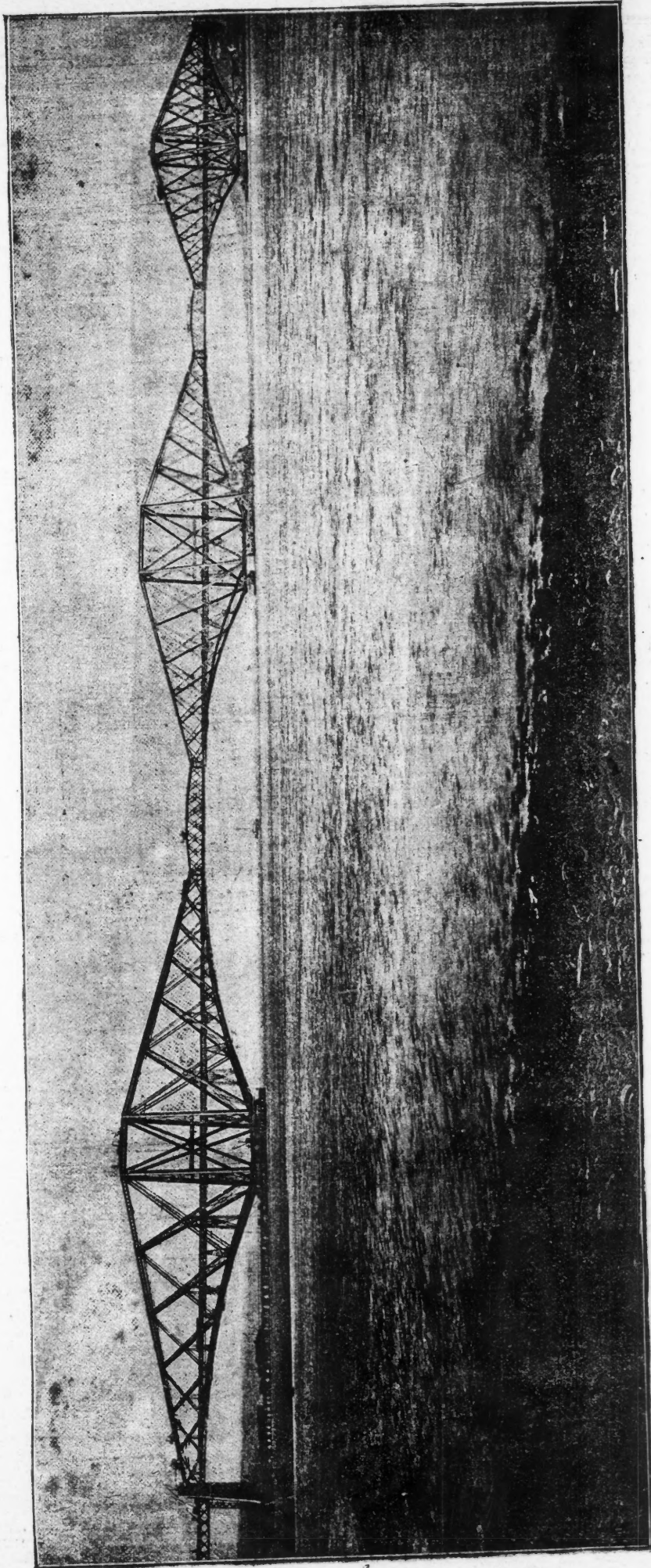
The bridge proper consists of three double cantilevers and two central connecting girders. Each double cantilever consists of a central tower supported on four circular masonry piers—a cantilever projecting from each side of it. The two outside piers—the Fife and Queensferry—have, in addition to the four supports of their central towers, a further support, inasmuch as their outer cantilevers rest in the cantilever end piers. No such additional support was available in the case of the Inchgarvie pier, and the length of the base has here been nearly doubled. The reasons for this are given further on.

The length of the cantilever bridge is 5,330 feet, consisting of the central tower on Inchgarvie, 260 feet; the Fife and Queensferry central towers, 145 feet each; the two central connecting girders, 350 feet each, and six cantilevers of 680 feet each. The cantilever end piers are apart 5,349 feet 6 inches from center to center. The South Approach Viaduct is 1,978 feet long from center of cantilever end pier to end of arches, consisting of ten spans of 168 feet each; four arches of 66 feet each center to center, and 34 feet made up by abutments. The North Approach Viaduct to end of arches is 968 feet $3\frac{1}{2}$ inches long, consisting of five spans of 168 feet long; three arches of 37 feet, 31 feet and 46 feet center to center respectively, and 14 feet $3\frac{1}{2}$ inches made up by abutments. The total length of the structure is therefore 8,295 feet $9\frac{1}{2}$ inches. The two main spans are 1,710 feet from center to center of vertical columns, made up of two cantilevers of 680 feet each, and one central girder 350 feet.

The waterway to be crossed is about 5,700 feet, extending from the south circular piers on Fife to Viaduct Pier No. 3 at Queensferry. The rail level has been fixed at 157 feet above high water, which leaves, for a total length of 500 feet in the centre of each channel, a clear headway of 151 feet, no train load being on the bridge. The ordinary load of two trains is not expected to diminish this head way by more than $3\frac{1}{2}$ inches.

The Fife and Queensferry piers are alike and identical in every respect, and only reversed with regard to their outer cantilevers. All six cantilevers are the same in length—namely, 680 feet from center of vertical columns to center of endpost—and are also of the same height and width, namely, 330 feet high at the central towers, by 120 feet wide at bottom, and 33 feet wide at top, and 34 feet high at the endposts, with a width of 32 feet at bottom and 22 feet at top. The only difference in the cantilevers lies in the arrangements of the endposts, and further in the fact that the two outside or fixed cantilevers of Fife and Queensferry are somewhat heavier in construction than the others. Each cantilever consists of a bottom member, or compression member, and a top member, or tension member—these being braced together vertically by six pairs of cross-bracings on each side, and being closed at one end by the vertical columns, at the other end by endposts. The space occupied by each pair of side-bracings is termed a bay, of which there are six in each cantilever. The bottom members are connected together by 12 sets of horizontal diagonal bracings intersecting in center line, and further by the trestles and cross-girders, which carry the internal viaduct. The side bracings connecting top and bottom members consist each of a strut, or compression member, and a tie, or tension member, intersecting one another, and connected at the intersections by strong gusset-plates and other stiffening. Each pair of opposite struts is connected by diagonal wind-bracings both above and below the internal viaduct, and by a cross-girder at top between the top members. From the intersection of struts and ties in the sides of the cantilevers, lattice girders, called vertical ties, are carried downwards and attached to the bottom members, relieving the latter of deflection between the junctions.

Each central tower is formed of four columns, each column resting on



THE FORTH BRIDGE.

a circular granite pier. Transversely all these piers are 120 feet from center to center, or 60 feet on each side of the center line of the bridge. Longitudinally these piers are 155 feet apart from center to center in the Five and Queensferry piers, and 270 feet in the Inchgarvie pier. It follows that the central tower on Inchgarvie is much heavier in construction and different in several features from the other two.

All the circular granite piers are carried to a height of 18 feet above high water, and the height between the centers of bottom members and top members is 330 feet, measured vertically, which gives an extreme height of the central towers above high water of 361 feet.

The vertical columns—so called for distinction—are vertical only in one sense; that is, when looking broadside on. In the other sense, looking along the center line of the bridge, they have an inclination of about 1 in 7½, being apart, center to center, 120 feet at bottom and 33 feet at top. This batter of the vertical columns is maintained throughout the cantilever bridge. It had been intended to arrange the sides of the cantilevers so that the batter of 1 in 7½ in the central towers should gradually decrease until a vertical position was attained in the endposts and the central girders; but this plan would have led to considerable complications in the junctions both in top and bottom members, and in the intersection of struts and ties, and would have produced a twisted top member.

The investigations and experiments made by Sir B. Baker, and extending over several years, have led to the decision that all members under compressive stress should be of tubular form—circular by preference where admissible—this form being the strongest, weight for weight. This rule is, for structural reasons, only departed from in the struts of Bay 6 of the cantilevers and in the struts and top member of the central girders. All members under tensile stress are open lattice girders.

For the foregoing admirable description we are indebted to our contemporary, *Engineering*, and for the illustration to *Industries*.

WATER-JACKET LEAD SMELTING IN MEXICO.

Written for the *Engineering and Mining Journal* by Edgar L. Newhouse, E. M.

Owing to the fact that the new tariff bill proposes virtually to stop the importation of silver-lead ores into the United States, by imposing a duty of one and a half cents a pound on the lead contents of the ore, the many thousands of tons which are imported annually into this country from Mexico, will, should this bill become a law, be treated in Mexico instead of in the United States. This will necessitate the erection of smelters in various parts of the Republic with foreign capital, the bullion thus produced being shipped to England or Germany. European parties are in the field already, in anticipation of the imposition of this prohibitory duty, and are considering the advisability of erecting furnaces at the following points:

1. **TORREON**—A point on the Mexican Central Railroad at the terminus of the Mexican International, to smelt the lead carbonate ores from the Sierra Mojada and La Mula districts and silver (dry) ores from Zacatecas and Torreon and Durango, and obtaining its coke and coal from the Sabinas coalfields.

2. **AGUAS CALIENTES**—Further south, on the Mexican Central Railroad; drawing carbonate ores from the Sierra Mojada, galenas from about Guadalajara, dry ores from Zacatecas, Guanajuato and San Luis Potosi, and coal and coke from England via Tampico and San Luis Potosi.

3. **SAN LUIS POTOSI**—The capitol of the state of the same name, depending on Monterey, Charcas and Matehuala for its lead supply, and Catorce, Pachuca, Guanajuato and Zacatecas for dry ores. The bullion would be shipped via Tampico, and coke and coal received from England at the same port.

4. **MONTEREY**—The intersection of the Mexican National and Monterey & Gulf railroads; its own mines supplying the lead, also to be obtained from the Villaldama and Ceralvo districts, and along the new line from Monterey to Tampico, and drawing on Pachuca and Catorce for its silver ore. Inside of 18 months the railroad in course of construction to Tampico will be completed, allowing English and possibly Alabama coal and coke to be purchased at a less price than the Indian Territory (McAlister) coke.

5. **BARATERON**—There is also some talk of erecting smelters at this point on the Mexican International Railroad near the coalfields of the Coahuila Coal and Coke Company to secure the La Mula and Monterey lead ores and the Zacatecas dry ores. It is said a company has already been organized in England with a two-million-dollar capital, and will soon commence work. If the railroad from the Sierra Mojada to Monclova goes through, it will bring the ores from that district to the proposed smelter.

All it needs is an intimate knowledge of the Mexicans and Mexican business methods, to enable smelting works with a two hundred tons per day capacity to be a success and yield good dividends to investors.

At present there are only two small plants at work, one in the Sierra Mojada, the other at Guadalupe, near Villaldama station, on the Mexican National Railroad. It is to the latter one that I would draw the reader's attention.

This plant was originally built about five years ago, and consisted of two 40-ton furnaces, with necessary blowers, boilers, engines, pumps, etc., but possessing no means of saving the flue dust; this escaped up the stack, settled all over the surrounding country, and, aside from the loss, did considerable damage to the company's stock, etc. I have been told by the present general superintendent that the loss in smelting amounted to 22 per cent. and over. Even under these disadvantageous circumstances, it is said that the furnaces just about paid expenses. For the last two and a half years the works were closed down, all of the ore produced by the mines being sold to the Consolidated Kansas City Smelting and Refining Company, at Kansas City, and the Omaha and Grant Works, at Omaha. Last August, owing to the fact that most of the ores would, on entering the United States, be obliged to pay a duty of \$30 per ton, and from other business considerations, the company decided to rebuild the old furnaces, and commence work on an entirely different plan. For this purpose they expended about \$12,000 in building dust chambers, a brick stack 90 feet high, flue connections and remodeling of furnaces. The intention of the company was to use their own ore as a rule, the heavy Monterey and Ceralvo ore for lead, and Catorce dry ores

for silver. As the ores had to be purchased outright on the patio of the various mines, this necessitated a carrying capital of not less than \$100,000.

Analyses of ores from the Mexican Guadalupe Mining Company properties show an excess of FeO + CaO over SiO₂ of 35 per cent. and upwards.

Ore lot No.	1—Fe=23.2 per cent.	SiO ₂ =4.8 per cent.	CaO=4.0 per cent.
2—	33.8	5.8	4.5
3—	37.0	4.5	4.5
4—	38.5	4.5	3.9

The above ore lots ran from 5.7 to 7.6 ounces per ton in silver, and from 14.4 to 20.2 per cent. in lead; the moisture varying from 10 to 15 per cent. No attempt is made at the mines to separate the higher grade ore (much of which runs from 25 to 30 per cent. in lead and 18 to 25 ounces per ton in silver) from the lower grade. It is mined very cheaply; the cost, delivered on the cars at the mine, being a little under three dollars a ton, Mexican currency=\$2.25 United States value, and an additional 50 cents per ton for hauling it to the smelter, 28 kilometers' distance, over a narrow-gauge road built and owned by the company. The ore from these mines is exceedingly valuable to the smelters in the United States on account of the high percentage of iron and excess thereof over silica. They can consequently afford to pay good prices for the ore, because of its fluxing qualities. Again, the lead is in the form of cerusite or carbonate (also the zinc), requiring no roasting, and making it one of the finest smelting ores in the world. The only drawback the ore has is the fact of its containing varying amounts of arsenic and antimony. This, in smelting, combines with the iron to form a considerable amount of speiss, which serves to chill the lead well, increase the loss of lead and silver, and interfere with the running of the furnaces.

The Monterey ores run well up in lead, though poor in silver; have a lime gangue, and generally a considerable amount of zinc. One lot of about 150 tons taken from the "Americano" mine analyzed partially as follows: Ag = 7.5 ounces; Pb = 38.8 per cent.; SiO₂ = 5.0 per cent.; CaO = 12.1 per cent.; Fe = 3.5 per cent.; Zn = 8.2 per cent.; H₂O = 10 per cent.

The principal producing mines in this district, all of which were obliged to close down, on account of having no market for their output, are:

Mine.	Ag.	Pb.	Monthly output.	Gangue.	Zinc.
Alta Cruz	.20 ounces.	35 per cent.	300 tons.	Lime.	20 to 25 per cent.
Americano	8 "	45 "	500 "	"	6 to 10 "
San Juan	3 "	55 "	300 "	Iron.	4 to 6 "
Buena Vista	1¼ "	40 "	300 "	"	8 to 10 "

There are numerous other small mines tributary to Monterey, which could swell the monthly output to at least 2,000 tons. The Guadalupe Smelter pays for the lead and silver prices based on the English market, and deducts from \$6 to \$15 per ton for smelting charges, depending on the character of the gangue and percentage of zinc. For ores from the Ceralvo district, the company is obliged to give better figures.

The Catorce ores will run from 75 to 250 ounces in silver per ton, no gold, and from 4 to 12 per cent. in lead (galena). The gangue varies considerably from a neutral ore (equal parts silica and lime) to an 88 per cent. silicious ore. A lot of 350 tons of the so-called "Colorados" from the Concepcion mine, containing 85.8 ounces of silver per ton analyzed: SiO₂ 71.2 per cent.; CaO = 5.0 per cent.; Fe = 7.9 per cent.; H₂O = 1 per cent. While the "bronze" ore from the same mine gave SiO₂ = 84.9 per cent.; CaO = 6.1 per cent.; Fe = 4.2 per cent.; H₂O = 1 per cent. These ores can be purchased laid down at the smelter yards, allowing a smelting charge of \$17.50 United States currency.

As may be seen from the foregoing, the Guadalupe furnaces are in a position to avail themselves of the outputs of the many mines from the camps mentioned and in their immediate vicinity, so as to secure a proper admixture for a good charge.

Obtaining Fe₂ from their own ores, CaO and Pb from Monterey and Ceralvo, and SiO₂ and Ag from Catorce.

The percentage of lead in the charge is kept from about 18 to 20 per cent. A thousand pound charge is made up of:

About 500 lbs. Minas Viejas ore from Guadalupe.	
" 250 " Concepcion " " Catorce.	
" 250 " Americano " " Monterey.	

Labor itself is very cheap, from 50 cents to \$1.00 per day, thus making cost of smelting low (without considering interest, insurance and wear and tear).

Cost of smelting per day of 24 hours:

	U. S. Cur.	Mexican.
Skilled labor, including office, superintendent, etc.	\$ 35.50	\$46.15
Labor, native Mexican	38.46	50.00
Coal and Wood	27.00	35.00
Coke	135.30	176.00
Oil	1.54	2.00
Material, iron, timber, etc.	10.00	13.00
	\$247.80	\$322.15

The furnaces put through from 66 to 70 tons of ore per day, which brings the smelting cost per ton to about \$4.88 Mexican currency = \$3.75 United States currency. The McAlister coke, obtained from the Indian Territory, contains from 12 to 16 per cent. of ash, and costs, laid down at the smelter, \$14.30 Mexican currency per ton = \$11 United States coin. There is no duty on it.

The bullion, put on the cars at Guadalupe station, nets the smelter, when shipped to England, via New Orleans, in bond, all of the silver at 92 cents per ounce, and all the lead at from 1 to 1½ cents per pound United States currency. This bullion runs from 130 to 200 ounces per ton in silver. It takes nearly three months, from date of shipment, before final returns are received from abroad. For this reason, several lots have been sent to the Chicago and Aurora Smelting and Refining Company's works, at Aurora, Ill., paying the duty of \$40 per ton on the lead. It is only a question of a few years before all the Mexican ores will be smelted in their own country.

Rubber Pavement.—The rubber pavement, invented by Busse-Hannouer, consists of 85 per cent. of ground stone and 15 per cent. of a rubber mass, which after a special treatment is mixed with the stone powder. This pavement material is entirely even, and, when applied to the street on top of a layer of concrete, looks like asphalt, although not as smooth as this; it produces no dust and is noiseless.—*Chem. Ztg.*, February 26th.

NATURAL GAS EXPLORATIONS IN THE EASTERN ONTARIO PENINSULA.*

By the late Charles Albert Ashburner.

The first practical search for natural gas between Quebec and Montreal was made in 1880 by Messrs. Piret and Genest, who sunk a well near St. Maurice to a depth of 50 feet. Another well, drilled by Renand Frères & Dubois, struck a small reservoir of gas embedded in the porous glacial gravel. This, and some other drift-gas pools, proved valueless, as is always the case with drift-gas, except in some parts of Illinois, where it is profitably utilized in the immediate vicinity of the wells.

The attention was naturally directed to the underlying Trenton limestone, the middle member of the Siluro-Cambrian period, specially after the discovery, in Ohio and Indiana, of abundant gas in a similar geological horizon.

The oil prospecting activity in New York, started in 1865 and, owing to the frequent co-existence of oil and gas,† stimulated in 1880 when natural gas began to be used as fuel, led to the discovery of natural gas in profitable quantities between Albany and Buffalo. Wells drilled in the latter city in 1883 showed natural gas at depths from 415 to 460 feet in the lower part of the Salina lime shales.

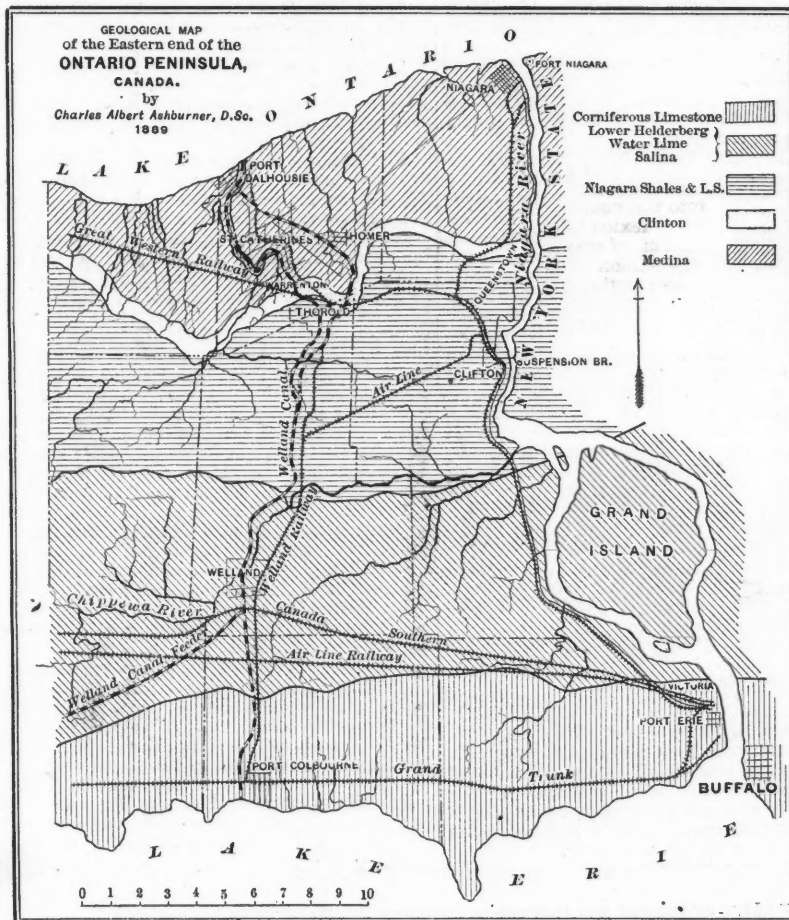
On these suggestions wells were put down at Port Colborne between Lakes Ontario and Erie; gas was found at a depth of 760 feet, but the 1,500 feet deep well failed to reach the Trenton limestone. As the gas found probably had leaked into higher strata from the Trenton limestone, and this would be easier of access north of Port Colborne, because of the general upward dip of the strata towards the north, wells were sunk at Thorold and at St. Catharine.

at a number of places in the Medina, Hudson, Utica and Trenton strata; the largest pool, which produced about 100,000 cubic feet per day, but was soon exhausted, was found about 500 feet below the top of the Trenton limestone. An examination of the drillings from this gives no promise of commercial quantities of gas.

The following general section of the strata in the Niagara region show the results of a study of the combined records of the wells mentioned :

	Thickness.	Depth.
No. VIII. Devonian. Corniferous limestone.....	25 ft. to 25 ft.	
No. VII. Oriskany sandstone.....	Wanting.	
Silurian		
Lower Helderberg limestone.....	Wanting.	
Water lime.....	Wanting.	
(The buffalo cement bed is one of the top strata of the Salina, and does not belong to the water lime group, as popularly supposed.)		
No. VI. Salina or Onondaga limestone and shales.....	500 ft. to 525 ft.	
Niagara limestone.....	135 " 630 "	
Niagara shales.....	70 " 750 "	
No. V. Clinton limestone and shales.....	50 " 800 "	
No. IV. Medina sandstone and shales.....	350 " 1650 "	
Oneida sandstone and conglomerate.....	Wanting.	
Siluro-Cambrian and Cambrian.		
No. III. Cincinnati Hudson River shales }.....	785 ft. to 2435 ft.	
Utica shales and slates }		
No. II. Trenton limestone }.....	677 ft. to 3112 ft.	
Black River limestone }		
Birdseye limestone }		
Chazy limestone }		
Quebec limestone }		
Calcareous sandstone.....	18 plus 3130 ft.	

The corniferous limestone outcrops may be found in Buffalo and at



The region surrounding the latter was known to contain gas and to have numerous veins of mineral—special saline—water, 1,000 parts of which contain in grains of mineral constituents:

	Stephenson Well.		Adams Well.
	1860.	1862.	1862.
Chloride of sodium.....	29.8034	23.	19.94
" " potassium.....	.3555	trace	trace
" " calcium.....	14.8544	9.66	6.49
" " magnesium.....	3.3977	2.40	1.95
Iodide of sodium.....	.0042	trace	trace
Sulphate of lime.....	2.1923	1.75	1.77
Total.....	50.6075	36.81	30.15

Favorable to the existence of gas in the Trenton limestone in the vicinity of St. Catharine were the presence of strata which in Ohio, New York and Pennsylvania carry gas in commercial quantities, the structure of the rocks and the low dip mentioned, averaging 35 feet per mile.

In the St. Catharine well, drilled to a depth of 2,200 feet, gas was struck

* Abstract of a paper in the Transactions of the American Institute of Mining Engineers.

†The belief that gas is being continually produced and that gas and petroleum occur together, needs to be qualified. Where there is gas there is petroleum, and vice versa, but not in commercial quantities. Still, the occurrence would warrant a close examination of the district of Pittsburgh, Pa., which might disclose new pools of gas and valuable reservoirs of petroleum. The Ontario peninsula contains probably no economically profitable oil.

Black Rock, the outcrop occurring 52 feet above the surface of Lake Erie, or 625 feet above tide. The Salina limestone and shales immediately below the Corniferous limestone, underlies all the level country from Black Rock to about two miles south of Niagara Falls, a distance of 15 miles by the river. A stratum of the Niagara limestone, 75 feet below the top of the formation, forms the knuckle of the Falls. Between the Falls and the mouth of the river at Lake Ontario, a vertical thickness of 550 feet of the Silurian strata is boldly exposed, extending 350 feet vertically down into the Medina formation.

The conclusions arrived at, concerning the occurrence of natural gas, are that the Buffalo gas comes from the lime shales 15 to 60 feet above the bottom of the Salina formation; that the top of the Trenton limestone under Buffalo should be encountered at a depth of 2,400 feet; that gas in commercial quantities must be covered by at least 400 feet of strata; and that in the southern portion of the Ontario peninsula, natural gas is likely to be found in the lower part of the Salina, in the upper part of the Medina formations, and, in a smaller degree, in the upper part of the Niagara limestone and in the Hudson River and Utica shales and sandstones.

Water Consumption in London.—The average daily consumption of water (in September, 1889) in London, England, was 177 1/2 million gallons or, the population being 5 1/2 millions, 31.71 gallons per inhabitant, or, the number of houses being 755,850, 225 gallons per house. The water used for street cleaning is per inhabitant about 5 gallons per day; whilst in Paris it amounts to between 24 and 25 gallons.

ENGINES FOR ELECTRIC LIGHTING.

The accompanying cut illustrates one of these special engines designed by the Bell Engine Company, of Erie, Pa., to be used with Edison dynamos on board the United States cruisers "Concord" and "Bennington," two engines and dynamos being installed in each ship. These engines are the first of this type for this service.

It will be seen that they are double-acting vertical cross compounds, self contained, and arranged to be shut and made self-lubricating if desired. The vertical type was chosen for this work because less floor space is required, and the necessarily short stroke permitted a height over all that could be used between decks. The double engine form with cranks set opposite was adopted, because one side would thus in a measure counter-balance the other, and it was believed that two small engines with light running parts and small crank pins could be run satisfactorily at a higher rate of speed than a single engine with heavier parts having the combined power of the double engine.

This engine was designed as a compound because, with the necessary large clearance and short stroke, very little expansion would be possible with a single cylinder.

The indicator cards show a very economical use of steam by expanding it a second time in the low-pressure cylinder. A shaft governor of special construction embodying the feature of the Ball engine governor is arranged on one end of the shaft, and the flexible coupling to the dynamo at the other.

These engines are guaranteed not to run one revolution slower under full load than when running without load, 400 revolutions being a good working speed. A change of boiler pressure from 100 pounds to 50 pounds is also guaranteed not to reduce the speed one revolution. In marine work, these changes of boiler pressure are often the most troublesome conditions to meet.

It often becomes, not a question of governing, but of capacity of the engine. For instance, a ship at sea has often 150 pounds boiler pressure and vacuum exhaust, and when in port 50 pounds of steam and atmospheric exhaust. An engine suited to either of these conditions would manifestly be quite out of proportion for the other.

It is proposed by the Bell Engine Company to meet these peculiar requirements in a very novel way, the arrangement being the subject of a pending patent. The engine for this service is practically the same as the one herewith illustrated, except that, by the shifting of a valve placed between the high and low pressure cylinders, ports connecting opposite ends of these cylinders are opened, and steam, admitted to the upper end of the high-pressure cylinder, passes directly into the lower end of the low-pressure cylinder by means of the port described, and steam, admitted to the lower end of the high-pressure cylinder, passes directly into the upper end of the low-pressure cylinder. Another valve turns the exhaust from both cylinders into a common exhaust pipe. With this arrangement, the engineer can instantly, without stopping the engine, change from a compound to a double direct engine operated by the governor, and each cylinder has its own exhaust valve. It is intended to proportion the cylinders so that satisfactory results would be obtained as a compound between 100 and 150 pounds pressure and vacuum exhaust. Below 100 pounds pressure with atmospheric exhaust there would be a lack of capacity as a compound, but changed to a direct double engine, the load could be carried down to 40 or 50 pounds pressure and still have the engine under control of the governor. The wire drawing of steam passing through from high-pressure to low-pressure cylinder would have a tendency to reduce the pressure on the larger piston, and to that extent divide the work more evenly than would be the case if both cylinders were acted upon by the same pressure.

This arrangement would seem to meet the peculiar conditions of marine work in a very satisfactory manner, and although specially designed for marine work these engines are very suitable wherever space is valuable or difficult to arrange.

French Production of Iron and Steel in 1889.—The official statistics of the production of iron and steel in the year 1889 have just been published. From these we learn that the make of pig of all sorts amounted to 1,722,480 tons, of which quantity 940,719 tons were produced in the Meurthe-et-Moselle. The production of finished iron amounted to 793,358 tons, and that of steel of all sorts to 529,021 tons. This is a considerable increase for all classes on the production of the previous year.

THE PROPERTIES OF ALUMINUM, WITH SOME INFORMATION RELATING TO THE METAL.*

By Alfred E. Hunt, Jno. W. Langley and Chas. M. Hall.

(Continued from page 285.)
CORRODIBILITY.

Aluminum becomes covered on its surface, exposed to the atmosphere, by a very thin, almost imponderable coating of oxide, which seems to protect it from further oxidation. This coating is so thin as to interfere hardly in any way with the surface polish which the metal takes, and does not change the weight of the metal as determined by the most delicate of chemical balances.

In the chemical laboratory of the Pittsburg Testing Laboratory, we have a thin weighing scoop hammered out of an aluminum sheet, which weighed 2.2086 grammes eight years ago; it has not changed in weight one-tenth of a milligramme since.

The popular general statement that aluminum is unacted upon by air, either moist or dry, or by water, is practically true.

According to Deville, water, either at ordinary temperatures or at the boiling point has no action on aluminum. The accuracy of this statement the authors have very frequently verified, finding aluminum wire subjected to the action of steam and heated air, to retain its original polish and not to lose weight, after six hours' exposure.

Aluminum containing sodium is rapidly acted upon by hot water, dissolving out the sodium and leaving the aluminum spongy and weak, fit only to be remelted, whence it comes out purer and better in quality for its freedom from the sodium.

Aluminum is unacted upon by either concentrated sulphuric or nitric acid; hydrochloric acid is its natural solvent, and when either sulphuric or nitric acid is contaminated with any hydrochloric acid, even though in very small proportions, it rapidly corrodes aluminum; the hydrochloric acid, forming chloride of aluminum, which in turn is converted into sulphate or nitrate, is again set free in a nascent state to again attack the aluminum, and in this way the corroding chloride acts as a carrier for the sulphuric or nitric acid.

Aluminum is unacted upon by sulphuretted hydrogen, carbonic oxide, or carbonic acid gases, or by sulphurous acid or other sulphur vapors. These facts add much to the value of aluminum for many purposes where the tarnishing of silver is a serious inconvenience.

It is also practically unaffected by common salt, either wet or dry, and by sea water, and by weak solutions of salt in acetic acid.

A piece of aluminum $3\frac{1}{2}$ inches by $1\frac{1}{2}$ inch by $\frac{1}{16}$ inch was immersed for 23 days in a 3 per cent. solution of common table salt, at a temperature of 80 degrees Fahrenheit. The strip lost .025 gramme in weight—4.27 square inches were exposed; this would give a loss by corrosion per square inch per week of .00178 gramme. A similar strip was immersed for a similar length of time, under like conditions, in a solution of 3 per cent. common salt with 2 per cent. solution of No. 8 acetic acid. The action in this case was not confined to that portion immersed in the liquid, but a crust of basic salts was also formed on the portion of the plate above the liquid. The strip was frequently reversed, end for end, in order to equalize the action. This piece lost .165 gramme upon an area of 6.4 inches, or at the rate of .00785 gramme per square inch per week.

* These solutions were chosen as fairly representing extreme conditions to which aluminum would be subjected for domestic culinary operations. This corrosion is very slight, and of no practical consequence: being much less than tin plate or silver plate would suffer under similar circumstances.

Solutions of the caustic alkalis readily attack aluminum. In ammonia, aluminum turns gray in color, but does not lose weight or strength. Chlorine, bromine, iodine, and fluorine, attack aluminum and corrode it.

Aluminum is unacted upon by organic secretions, such as sweat, saliva, or the like; and the metal is finding considerable uses by dentists in the metal plates upon which to back false teeth, as well as by surgeons in tracheometer tubes, etc.; for these purposes the aluminum should be free from iron, as it is found that, where iron is present in the aluminum, the metal is acted upon by the saliva.

MECHANICAL PROPERTIES.

Aluminum is naturally a very soft metal. The results of a drop-testing

* Paper read at Washington Meeting of American Institute of Mining Engineers, February, 1890.

TABLE OF TENSILE AND COMPRESSION TESTS OF ALUMINUM IN VARIOUS SHAPES.

Size, shape, and condition of the aluminum.	Elastic limit pounds per sq. in. in ten- sion.	Ult. strength pounds per sq. in. in ten- sion.	Per cent. of reduction of area in tension.	Estimated safe unit strain per sq. in. in tension.	Original size of specimen used in compression.	After failure size of speci- mens used in compres- sion.	Elastic limit per sq. in. in compres- sion.	Ultimate strength per sq. in. in com- pression.
Metal of from 97 per cent. to 88.5 per cent. aluminum.								
Ordinary castings of over $\frac{1}{2}$ in. sectional area at cost.	6,132	15,640	8.06	3,000	1 in. high \times 5 in. dia.	.985 \times .503	3,565	12,730
Same annealed.	6,800	17,000	15.0	3,500	"	.975 \times .506	2,037	10,185
Same lot of castings hardened by drop forging.	10,000	24,000	18.0	3,000	"	.985 \times .508	4,583	15,275
Aluminum rolled bars left hard.	16,000	32,500	42.0	6,000	$1\frac{1}{2}$ in. high \times $\frac{3}{4}$ in. dia.	1.459 \times .760	2,263	8,064
Same annealed.	13,870	25,000	49.11	6,000	"	1.468 \times .756	2,043	6,809
Aluminum hammered bars left hard.	14,630	24,120	35.14	5,500	"	2.91 \times 1.52	5,659	11,320
Same annealed.	14,000	22,000	43.0	5,500	"	2.92 \times 1.519	5,094	11,320
Aluminum wire from $\frac{1}{4}$ in. to 1-16 in. dia. as drawn.	12,000	24,570	58.46	4,500	"	"	"	"
Same annealed.	10,870	22,830	65.57	4,500	"	"	"	"
Aluminum wire No. 14 to No. 20 B & S gauge as drawn	"	"	"	"	"	"	"	"
Same annealed.	"	"	"	"	"	"	"	"
Aluminum plate to $\frac{1}{2}$ in. thick as rolled.	9,800	22,740	12.4	4,000	"	"	"	"
Same annealed.	8,500	17,740	13.73	4,000	"	"	"	"
Aluminum plate No. 8 to No. 20 B. & S. as rolled.	12,500	25,000	35.5	4,500	"	"	"	"
Same annealed.	10,700	21,070	39.0	4,500	"	"	"	"
Aluminum sheets No. 20 to No. 30 B. & S. as rolled.	13,500	27,500	40.0	4,500	"	"	"	"
Same annealed.	11,000	23,000	43.5	4,500	"	"	"	"
Metal of 94 per cent. aluminum, 1.5 per cent. iron, and 4.5 per cent. silicon.	"	"	"	"	"	"	"	"
Sheets $\frac{1}{4}$ in. thick.	12,000	29,650	11.0	4,500	"	"	"	"
Castings $\frac{1}{4}$ in. \times 1 in.	10,500	25,550	9.5	4,500	1 in. high \times $\frac{1}{2}$ in. dia.	.965 \times .508	4,800	15,275

machine of the Pittsburg Testing Laboratory, in which an accurately ground, hardened steel point of 60 degrees, centrally fixed in a weight of 32 pounds, fell in guides a distance of 24 inches, were as follows:

MATERIAL.	Kind.	Depth and dia. of punch marks.
1. Aluminum, 1/4 inch thick.	Rolled.	.140 x .28
2. " " " "	"	.144 x .30
3. " " " "	"	.143 x .30
4. " " " "	Cast.	.176 x .32
5. " " " "	"	.177 x .32
6. " " " "	"	.145 x .29
7. " " " "	"	.144 x .29
8. " " " "	"	.177 x .32
9. Brass 7-32	"	.145 x .28
10. " " " "	"	.142 x .26
11. " " " "	Rolled.	.129 x .24
12. " " " "	"	.129 x .24
13. Copper 7-32	"	.111 x .24
14. Zinc 1/4	"	.118 x .24
15. " " " "	"	.111 x .24

These results show only partially the difference in the surface hardness

A wire of the average lot of 98.52 per cent. aluminum, suspended by a nearly torsional chord, exhibited no appreciable polarity.

An ingot of aluminum, containing .15 per cent. iron, showed a very faint trace of polarity; with 2 per cent. iron, the polarity was distinct and very decidedly marked.

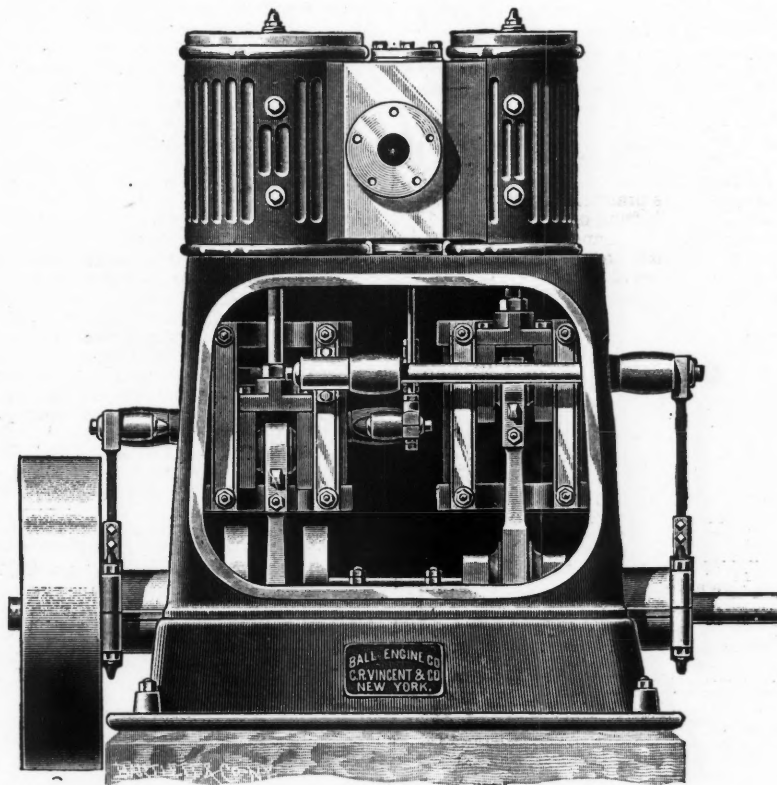
All commercially pure aluminum sold by the Pittsburg Reduction Company, contains less than 0.20 per cent. iron, much of it running as low as 0.04 per cent. iron. For this reason, aluminum will answer very well for compass boxes, or cases for electrical apparatus, where non-magnetic properties are desirable. Very few commercial metals, not chemically pure, contain as little iron as does aluminum; certainly all of the brasses, bronzes, or German silver contain a larger percentage of iron.

The tensile crushing and transverse tests of aluminum vary very considerably with the varying conditions of hardness, due to cold working, and also with the amount of work that has been put upon the metal, the character of the section, etc., as will be shown by the following tables of averages tests, selected from very many, of what the metal will stand.

The flow of aluminum under tensile tests is very local, the percentage of elongation decreasing very rapidly as it is calculated in increasing lengths from point of fracture.

TRANSVERSE TESTS OF ALUMINUM IN VARIOUS SHAPES.

From the above results as averages, we submit the following table of



THE BALL ENGINE FOR ELECTRIC LIGHTING.

due to cold-working aluminum. Castings of aluminum, made a little larger than the finished object desired and drop-forged in dies, will very considerably harden the metal and add to the rigidity of many bearings where great weight does not have to be sustained. For bearings of surveying instruments, the metal hardened in this way answers very satisfactorily.

Wire and sheets of aluminum can be left in this hardened state, having the hardness of brass and a good deal of elasticity and spring. The Eureka Tempered Copper Company, North East, Pennsylvania, has succeeded in hardening castings in aluminum in the same way it has hardened copper. Hardened aluminum castings are on exhibition at the Washington meeting.

As referred to before, the most careful and delicate tests have failed to show the slightest hardness given to aluminum by the process of "chilling" as practiced with cast iron. The surfaces of the metal poured against the cold hard metal surfaces, seem as soft as any other portions of the same aluminum.

Pure aluminum is one of the most ductile and malleable of metals, and can be drawn into the finest wire and rolled to sheets of 0.0005 of an inch thickness. It can also be hammered into foil as thin as gold leaf. The relative malleability of aluminum, as shown by its capacity to beat out well into thin foil, is one of the best tests of the purity of the metal. The less percentage of silicon and iron in the metal, the better and more readily it works up under the beater's hammer. Metal of more than one per cent. of impurity, will not beat out well into foil.

Pure aluminum is absolutely non-para-magnetic; the same remark applies practically to aluminum with 0.05 per cent. iron in its composition.

what we believe will be found to be the average tension and compression-tests of commercially pure aluminum of composition varying in each constituent, as follows:

- Aluminum, from 97 to 99 per cent.
- Silicon, graphitic, from 0.10 to 1.00 per cent.
- Silicon, combined, from 0.90 to 2.80 per cent.
- Iron, from 0.04 to 0.20 per cent.

	Pounds.	Per cent.
Elastic limit per square inch in tension castings.....	6,500	
" " " " sheet.....	12,000	
" " " " wire.....	18,000	
Ultimate strength per square inch in tension castings.....	14,000	
" " " " sheet.....	15,000	
" " " " wire.....	30,000	
" " " " bars.....	28,000	
Percentage of reduction of area in tension castings.....	15	
" " " " sheet.....	35	
" " " " wire.....	60	
" " " " bars.....	40	
The modulus of elasticity of aluminum in castings is about.....	11,000,000	
" " " " sheets.....	13,000,000	
" " " " drawn wires.....	19,000,000	
Elastic limit per square inch under compression in cylinders with length twice the diameter.....	3,500	
Ultimate strength per square inch under compression in cylinders with length twice the diameter.....	13,000	

Taking the tensile strength of aluminum in relation to its weight, it is as strong as steel of 80,000 pounds per square inch. Comparative results

in this way are tabulated below as taken from Richards' work on "Aluminum":

	Weight of 1 cubic foot, in pounds.	Tensile strength per square inch.	Length of a bar able to support its weight, in feet.
Cast iron.....	444	16,500	535
Ordinary bronze.....	525	26,000	9,833
Wrought iron.....	480	50,000	15,000
Hard structural steel.....	490	78,000	23,040
Aluminum.....	168	26,000	23,040

Mierzinski is quoted from Dingler's magazine as giving the following results of tensile tests of aluminum wire:

Diameter. Millimeters.	Tensile strength.		Grammes. Mean.	Tenacity.	
	1st trial.	2d trial.		sq. millimeter	per sq. in.
0.225	601	653	657	12,975	18,360
0.295	524	501	515	12,255	17,427
0.103	307	311	309	12,700	18,059
0.145	246	252	249	11,845	16,844

Aluminum when pure is a very sonorous metal; bars of it suspended by fine wire when struck give a fine, clear, bell-like sound. The proper shapes for bells have not yet been devised, as bells of ordinary shapes do not give as good sound as do ingots of the metal.

CONDUCTIVITY AND ELECTRO-POSITIVENESS.

In the electro-chemical series, aluminum is ordinarily placed near the positive end, being under most circumstances more positive than almost all the other metals, and only less positive than the metals of the alkalies and alkaline earths. That is, in most separations of aluminum by electrolysis, it is charged with positive electricity, and separates out at the negative pole. This arrangement, however, is only approximate. Under some circumstances aluminum is electro-positive to sodium, as it reduced sodium when treated with its oxide or carbonate; again, it is electro-negative to iron, as iron reduces aluminum from its sulphide.

The attraction of aluminum for oxygen is only exceeded by that of very few elements. If this attraction be measured by the amount of heat developed in the combination of aluminum and oxygen, it is about three times that of carbon for oxygen, as the amounts of heats produced by equivalents of aluminum and carbon in combining with oxygen approximately as three to one (C+O₂ giving 96,000 units of heat; Al₂O₃ giving 388,000 units of heat; C=1 equivalent carbon Al=1½ equivalent oxygen).

The powerful attraction of aluminum for oxygen is turned to practical account in the use of aluminum to remove oxygen from molten steel.

In its behavior with most chemical re-agents at ordinary temperatures, aluminum resembles platinum and gold. It is like carbon and silicon, which are highly electro-positive at high temperatures, but electro-negative at low. Under some circumstances, as in nitric acid, aluminum is as electro-negative as platinum or carbon.

It is suggested that at low temperatures the atoms of aluminum are combined with each other so as to render the metal inert.

If its full chemical affinities were exhibited at low temperatures, it would be as easily oxidized by acid and water as metallic sodium.

Mr. C. K. McGee, of the University of Michigan, has determined the electrical resistance of specimens of aluminum of the "average lot 98.52 per cent." metal of page 285, with the following results:

Specimen used.	Diameter in inches.	Resistance in "legal ohms" of 1 yard.		
		at 14° C. = 57° F.	at 76° C. = 170° F.	at 170° F.
Unannealed Al. wire.....	0.325	0.5749	0.7201	0.6928
Annealed Al. wire.....	0.325	0.5484	0.6928	0.6928
Pure copper wire has the following resistance.....	0.325	0.315	0.387	0.387

We find the thermal conductivity is very nearly inversely as its electrical resistance, for unannealed aluminum wire at 14 degrees C. has a conductivity of 17, where copper has the thermal conductivity of 32, the rates being as 1 is to 1.88. Confirmatory accurate determinations are now being made at the University of Michigan, by Professor Carhart, which we hope to embody in the final revision of the text of this paper.

ACTION OF IMPURITIES.

As stated under the head of Purity of Aluminum, silicon and iron form the bulk of the impurities, and these two elements will be treated first.

Silicon hardens aluminum considerably, increases its tensile strength without materially decreasing its ductility; it, however, very materially decreases its malleability, and takes away its capacity of taking a fine polish, and much more prevents its retaining whatever polish it has received. Silicon in aluminum oxidizes by action of the atmosphere or of moisture, and if present in proportions of over three per cent., very soon coats the metal with a dull gray and unsightly tarnish.

For some purposes, where a harder surface is required than is given by pure aluminum, and where advantages would be taken of the lightness of the metal, and where the surface can be lacquered or otherwise coated to prevent it from oxidation, the alloy, say six to eight per cent. of silicon, which can readily be made, can be used with advantage, but in all ordinary work to which aluminum is placed, the freer the metal from silicon the better. These remarks apply to the ordinary ways in which we find silicon, a large portion of which exists in the graphitoid form. Whether the influence of the amorphous silicon, could it be placed in the metal alone free of graphitoid silicon, would give the advantageous hardness without the tarnishing qualities, is an interesting question not yet determined.

Iron in small percentages as an impurity of aluminum hardens it, but, of course, adds to its specific gravity and renders it magnetic. It also decreases the malleability of the metal, and, like silicon, detracts from the capacity of the metal to take a fine polish or to retain whatever polish it is at first susceptible of, although the alloy does not tarnish as rapidly as does the siliconized metal. For some purposes where a harder and stouter alloy is wanted, a proportion of from six to ten parts of iron works advantageously.

W. J. Keep has pointed out the curious fact that the alloy of 50 per cent. iron and 50 per cent. aluminum, although melted together and seemingly forming a true alloy in the pot and in the metal as first cast, seems to entirely lose its power of cohesion and crumbles down to a powder in the course of a little while. Each grain of this powder seems to contain equal parts of aluminum and iron.

Copper sometimes becomes an accidental impurity of commercially pure aluminum in proportions up to perhaps one-half per cent.; in such small percentages its influence is hardly noticeable in any of the properties of the metal, so far as has come to our notice.

In larger proportions, up to 10 per cent. of copper with the aluminum, the metal can readily and advantageously be alloyed, especially for casting where hardness of surface is required. It takes away the peculiar polish of aluminum, and the fine gloss and peculiar color of cast aluminum; at the same time, it adds hardness and decreases the shrinkage of castings, and for many purposes can be used advantageously. It has the disadvantage of adding materially to the specific gravity of the metal.

Carbon only unites with aluminum under very high and continued heat, and then only in proportions not exceeding three per cent. Wherever it is found associated with aluminum, the metal is brittle and porous and friable.

[TO BE CONTINUED.]

Iron Ore on Staten Island.—It may not be generally known that there are deposits of brown hematite (limonite) on Staten Island, Richmond County, N. Y. The principal openings are the New Dorp, the Towle and the Cooper & Hewitt mines, Middletown, and Tyson's mine, Castleton. These mines are all in the northeastern part of the island. They have been idle for about ten years. Some of the deposits were worked early in the century. Dr. N. L. Britton estimates the total production at 250,000 tons up to the time when work was suspended. Although the nearest iron mines to New York City they, like the mines of the lower Hudson River, are at a disadvantage in being distant from furnaces and fuel. The ore lies upon serpentine or talcose rocks, is generally covered by glacial drift, and ranges up to 12 feet in thickness. It contains a notable quantity of chromium.

Lacquer Anti-Corrosive Coating for Ships' Bottoms.—Some few years ago the Japanese Government decided on lacquering the bottoms of all their iron ships, and the results proved that corrosion was most effectually prevented, but the process does not seem to have been applied to any foreign ship until about two years ago, when the attention of the captain of a Russian frigate was directed to it, and lacquer was applied both to the iron and the zinc parts of the bottom. It was found that the adhesion of the lacquer to the latter was very slight, but on the iron, or rather steel, it was found to be in an extraordinarily good state of preservation, so much so that it could not be stripped off except by being scraped with a sharp instrument.—*The Steamship.*

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.

TUESDAY, MARCH 11TH, 1890.

- 422,903. Anti-Friction Journal. Bruno Beaupre, St. Paul, Minn.
 422,905. Regenerative Hot Blast Stove. Martin Boecher, Friedenschütte, Prussia, Germany.
 422,907. Artificial Fuel. John Bowing, London, County of Middlesex, England.
 422,911. Electromotor. Henry B. Butterfield, Waterville, Me.
 422,923. Slack Brake. Adolph Du Bois, Cincinnati, O., Assignor of one-half to Frank Tucherfarber, same place.
 422,927. Hydrocarbon Furnace. Margaret R. Flagg, Chicago, Ill.
 422,929. Hydraulic ram. Frank B. Hanson, New York, N. Y.
 422,939. Method of separating impurities from salt. Thomas Higgin, Liverpool, County of Lancaster, assignor by mesne assignments, to the Salt Union (Limited), London, England.
 422,954. Furnace grade. Frederick D. Livermore, Rochester, Minn.
 422,983. Car coupling. Robert F. Sillman, Troy, N. Y.
 422,988. Stone sawing machine. William A. Spring, Cleora, and Hiram H. Scoville, Chicago, Ill.
 422,994, 422,995. Boiler. Thomas L. Sturtevant and Thomas J. Sturtevant, Framingham, Mass.
 423,011. Hydrocarbon Burner. John Wilson, New York, and Allan Mason, Brooklyn, Assignors to Herbert H. Sanderson, trustee, New York, N. Y.
 423,012. Process of Burning Petroleum or other Hydrocarbons. John Wilson, New York, N. Y., and Allan Mason, Brooklyn, Assignors to Herbert H. Sanderson, trustee, New York, N. Y.
 423,044. Apparatus for the Manufacture of Oil Gas. William B. Frink, Revere, Assignor of one-half to William Stirling, Watertown, Mass.
 422,046. Endless Rope Power Transmission. John Gregg, Chicago, Ill., Assignor to the Link-Belt Machinery Company, same place.
 422,049. Annealing Furnace. Edmund A. Harvey, Wilmington, Del.
 422,057. Lubricator. Edward Humphreys, Williamsport, Pa.
 423,078. Railroad Rail. Elisha G. Patterson, Titusville, Pa.
 423,098. Safety Attachment for Boilers. John Watson, Cleveland O.
 423,151. Hydrocarbon Injector Burner. Charles Col, Chicago, Ill.
 423,152. Metallurgical Plant. Henry Alken, Homestead, Pa.
 423,202. Lubricating Device. Carl Anderson, Copenhagen, Denmark.
 423,214. Hydrocarbon Motor. Edward Butler, London, England, assignor to the Butler's Patent Petrol-Cycle Syndicate (Limited), same place.
 423,224. Compound Gas and Steam Engine. August B. Drautz, Stuttgart, Württemberg, Germany.
 423,225. Car Brake and Starter. Edgar Dredge, Stoke Newington, County of Middlesex, England.
 423,281. Alloy. William V. Shelton, Constantinople, Turkey, Assignor to Philip Syng Justice, London, England.
 423,282. Stone Crusher. Austin H. Smith, Brooklyn, N. Y.
 423,383. Friction Clutch. Philip Medart, St. Louis, Mo., Assignor of one-half to William Medart, same place.
 423,384. Die and Die-Holder for Drawing Steel Rods. Stephen Moltrup and William Moltrup, Beaver Falls, Pa.
 423,347. Apparatus for Generating and Burning Gaseous Fuel in Furnaces. Egbert P. Shetter, Renfrew, Pa., Assignor of one-half to Charles Mullen, same place.
 423,357. Hot Blast Oven. Ernest Tourangin, La Forest St. Florent, France, Assignor by direct mesne assignments to Louis Durand, New York, and Frederick A. Reid and Joseph H. Colyer, Brooklyn, N. Y.
 423,371. Railway Rail. John M. Brosius, Atlanta, Ga.
 423,375. Apparatus for Casting Steel. William M. Cooper, Allegheny, Pa.
 423,378. Stone-Sawing Machine. David D. Drummond, Chicago, Ill., Assignor of one-half to Lauritz I. Larsen, same place.
 423,387. Self-Turning Well Drill Attachment. William T. Nance, Fall Creek, Tenn.

PERSONAL.

Mr. R. C. Legg, former superintendent, is again in charge of the Brooklyn Mining Company, Utah, Mr. John Treweek having resigned.

Mr. William T. Zell has been appointed Treasurer of the Lehigh and Wilkes-Barre Coal Company, succeeding Mr. S. R. Lang, deceased.

Mr. C. H. Palmer, Superintendent of the Butte & Boston Mining Company, of Butte, Mont., has been passing a few days in Boston, and is now on his way to Montana.

Mr. Wm. M. Curtis, the well-known mining engineer and metallurgist, of Detroit, Mich., has returned from a long trip in Mexico, Arizona and New Mexico, where he has been on professional business. He is now again open to engagement.

Mr. Marcus Daly, it is rumored, will resign as manager of the Anaconda Copper Company, Mont., owing to ill health. It is stated that he will be succeeded by Mr. Robert Dallan, who at present has charge of some other mining operations for Mr. J. B. Haggin.

Mr. P. V. Lidner has been engaged as assayer by the Wisconsin Lead and Zinc Company, Schullsburg, Wis. Mr. Lidner is one of the many professional gentlemen who has secured his position through the ENGINEERING AND MINING JOURNAL'S column of "Positions Vacant."

Captain J. W. Plummer, former superintendent of the Granite Mountain Mining Company, has been appointed general superintendent of the property of the Mining and Financial Trust Syndicate, of London, England. This company recently purchased the Elkhorn mine, Montana.

Mr. H. W. Rodda, a well-known mining man, has been appointed superintendent of the mines of the International Company, Santa Clara district, Lower California, to succeed Mr. Harry Ayers, who has accepted a position in Durango, Mexico. Mr. Rodda will have entire charge of the company's mines.

Pursuant to an act of the Pennsylvania Legislature Governor Beaver has appointed J. A. Price, of Scranton; P. M. Shaffer, of Pottsville, and Eckley B. Cox, of Drifton, a committee to investigate the waste occasioned by the mining and preparing of coal in Pennsylvania, with special reference to the reduction and utilization of said waste. An appropriation of \$2,500 for expenses has been made.

Mr. R. D. Millet, mining and mechanical engineer, who left this country three years ago under engagement to a London and Buenos Ayres syndicate, has visited the principal mining districts of Argentine Republic, Uruguay and Brazil. He will visit Chili and Bolivia before his return to England. Thence to the United States to report on mines belonging to members of the same syndicate and on other mines offered to them for sale.

The Brussels *Mouiteur* publishes the report of the jury appointed to judge the papers sent in for the mixed competition of 1888, opened by the King of the Belgians, and having as its object: "The best work on electricity as a motor and as a means of lighting, on the applications which are or may be made of it, and on the economic advantages likely to result from the employment of electricity." The international jury, presided over by M. Montefiore Levy, Senator, has placed first among the works submitted for competition; "The Elementary Treatise on Electricity and Magnetism," by MM. Van Rysselberghe, E. Lagrange and G. Royers; but, while recognizing that this work answers more exactly than any other to the object of the competition, the jury regrets to state unanimously that it cannot award the prize. The secretary reporter to the jury was M. Eric Gérard, director of the Liège Electro-Technical Institute.

OBITUARY.

William C. Kimball, a prominent member of the New York Stock Exchange, died suddenly in this city on the 8th inst.

Mr. William H. Jones, of the firm of Messrs. Johnson & Jones, coal dealers, at Buffalo, died suddenly last week of paralysis of the heart.

M. P. McDonough, a Harlem architect, of the firm of McDonough & O'Sullivan, architects, contractors and builders, died from the effects of a fractured skull caused by a blow from some hard weapon wielded by an unknown assassin.

Matthew Byrnes, one of the most prominent contractors and builders in New York, died on the 10th inst., aged 81 years. In 1852 Mr. Byrnes began his career in New York, and since then he has constructed more than a thousand buildings in this city.

Judge Andrew J. Davis, one of the richest men in Montana, died at Butte on the 12th inst., aged 71 years. It is said that twelve years ago Mr. Davis took the Lexington mine in Butte for a \$50 debt. He afterward sold it for a large price. He was also interested in other mines.

Col. Howard M. Smith, of the new coal firm of Smith, Bartlett & Sears, of Buffalo, died Tuesday

of Bright's disease, aged 51 years. He was formerly with the Pennsylvania Company, afterward with Messrs. Andrew Langdon & Co. and Messrs. W. H. Davis & Co. During the civil war he served in the 130th N. Y. Infantry and 1st N. Y. Dragoons. Yesterday afternoon the funeral took place. Previous thereto, the local anthracite coal men met in the office of the Pennsylvania Company and adopted a memorial testifying to Mr. Smith's honorable record as a merchant, and to his great private worth.

Ebenezer L. Roberts died at his home in Brooklyn on the 13th inst. He had long been well known there and in New York as a successful architect and builder. He was born in Middletown, Conn., about sixty-five years ago, and received a common-school education. His taste for the profession which he afterward adopted was marked from the first. He began his work as a carpenter and builder at Meriden, Conn., and came to New York about 1850. Many important buildings in this city and Brooklyn are the work of Mr. Roberts. Among them are the Standard Oil Building, at 26 Broadway; the Ninth National Bank Building, St. Paul's Methodist Church, Fourth avenue; the Madison Avenue Dutch Reformed Church, and the Epiphany Baptist Church. In Brooklyn may be mentioned the Phoenix Building and many others.

INDUSTRIAL NOTES.

A charter has been issued to the Samuel J. Creswell Iron Works, of Philadelphia, Pa.; capital, \$100,000.

Messrs. Hiller Brothers' steel works and Messrs. Davis & Douglass' tool works, Newark, N. J., were burned on the 12th inst.

The Stewart Iron Works, at Sharon, Pa., are making many improvements. They are taking the steam hammer out of the mill and putting in a set of squeezers and muck rolls. Both blast furnaces are on Bessemer now.

The Wainwright Manufacturing Company, of Boston, Mass., has just shipped seven, 200 horse-power each, of its improved corrugated copper tube condensers to the Carolina Oil and Creosote Company, Wilmington, N. C.

Messrs. Fuller & Warren, proprietors of the Clinton Foundry, the largest stove manufacturing establishment in Troy, N. Y., have been requested to remove their business to Joliet, Ill., and the company intimates that the proposition will be accepted.

Messrs. Ames and Pritchard, representing the Union Iron Works of San Francisco, left Philadelphia, Pa., on the 11th inst., for California with fifty iron molders, who are to take the place of the striking union men in their shops. The men are all skilled mechanics.

The Prospect Rolling Mill, of Cleveland, O., was closed on the 11th inst. and the hands paid off. It is stated that the debts of the company will amount to over \$100,000. The works were on a big scale, and the failure is due, it is said, to a lack of capital necessary to prosecute the business on the dimensions projected by the owners. The sheriff has made an attachment.

The Pittsburg Reduction Company, of Pittsburg, Pa., has quite a number of orders from steel works for ferro-aluminum in large quantities, and also from foundries, where it is used for improving the quality of foundry castings. The new building is progressing rapidly, and the enlarged plant will be in operation in a month or six weeks, with a capacity of 1½ tons per week.

The Mersey Docks and Harbor Board have instructed the well-known manufacturers of dredging plant, Messrs. Simons & Co., of Renfrew, on the Clyde, to design and construct powerful sand pumping appliances to be fitted to one of the steam hopper barges constructed by them some time ago for the board. When completed the apparatus will be employed to cut a deep channel through the outer bar of the Mersey.

The Carroll-Potter Boiler and Tank Company, successors to D. W. C. Carroll & Co., of Pittsburg, Pa., has just furnished a plant for its special work. We are advised that this is one of the finest plants in this section of the country. The company has all the necessary facilities for carrying on work, including traveling crane; 20-foot bending rolls, 20-foot plate, 20-foot spacing table, 10-foot riveter (steam), and other tools in proportion.

The new wire nail mill of the Braddock Wire Company, at Braddock, Pa., is rapidly nearing completion, and will probably be put in operation in about 60 days. The mill will be one of the largest in the country, and will have a capacity of from 1,500 to 2,000 kegs of wire nails per day. The company has been compelled by its largely increased business to move the general office to this city, and it will hereafter be located in the Lewis Block, Pittsburg.

The wire nail men interested in the Trust closed their works on the 10th inst., and announce that they will not resume operations again until the 24th inst. This shut down, it is alleged, is part of

a scheme to force certain manufacturers of wire nails into the Trust which has been forming for some time, but which may fail on account of the refusal of the independent factories to join the combination. Heroic measures are now to be attempted, and all mills favorable to the Trust shut down on the 11th inst.

The Sharon Iron Works, Sharon, Pa., are turning out a larger amount of finished iron per week than ever before. Several Hazard boilers have been put up five more are to be put up on as many new double puddling furnaces. No. 1 furnace has been rebuilt from the foundation up, and has been fitted up with all modern improvements. Three Whitwell stoves have been built. No. 2 furnace is making 90 tons a day now, and a McIntosh & Hemphill blowing engine, 35-inch steam and 84-inch blowing cylinders, has been erected.

H. K. Porter & Co. are shipping a novel little locomotive, narrow gauge, to the United States of Colombia. This engine has four driving wheels and a two-wheel rear-truck, and instead of a cab has an open canopy to protect the engineer. It is to be used on a street railroad, and will go round curves of only 30 feet radius. The puffing noise of an ordinary engine is avoided by using a noiseless exhaust. H. K. Porter & Co. have previously furnished some seven or eight other engines to the same company. They are also building locomotives for Cuba.

The Cambria Iron Company of Johnstown, Pa., which has—as already announced in the ENGINEERING AND MINING JOURNAL last week—leased the Baltimore & Ohio Rolling Mill at Cumberland, Ind., will take charge of the property April 1, and, it is stated, start operations on a large scale for the manufacture of steel. The advantage of the lease to the Baltimore & Ohio will be the money accruing for rental and the increased revenue to be derived from carrying freight between Cumberland and Johnstown, both of which places are situated upon its lines. The mills were built by the Baltimore & Ohio in 1871, and for many years were used as a hot-iron and rolling establishment for the manufacture of steel rails.

Some time since a number of changes were introduced in the hours of labor at Krupp's works according to *Kuhlours*. The working day was reduced to ten hours, and in winter work commenced at 7 A. M. The new arrangement has not been found to answer expectations and the old practice of starting at 6 has been reverted to; work is continued to 6 P. M., with stoppages in between amounting to two hours. It has also been found that the longer midnight stoppage is attended with inconvenience both to the men and the work, and it has been reduced to half an hour. In all branches except the fire work the night shifts will begin at 6 P. M. and stop at 4.30 A. M. The ten-hour-working day is retained, which represents a sensible relief to all the one shift branches wherein the work formerly lasted 11 hours.

CONTRACTING NOTES.

The suit of Charles Hansen against Henry B. Slavin, the Panama canal contractor, to recover \$1,210,000, was begun in the Superior Court at San Francisco, Cal., on the 8th inst. He alleges that in 1882 he agreed with Henry B. Slavin and M. A. Slavin, since deceased, to subscribe for 2,000 shares of the stock of the American Contracting and Dredging Company, which the Slavins controlled. The stock, however, was never delivered, though he stood ready to pay for the same. The value of the shares and of the dividends declared would now amount to the sum sued for. H. B. Slavin says that Hansen never paid a dollar for any of the stock, and had never even asked for any.

MACHINERY AND SUPPLIES WANTED AT HOME AND ABROAD.

If any one wanting Machinery or Supplies of any kind will notify the "Engineering and Mining Journal" of what he needs, his "Want" will be published in this column.

Any manufacturer or dealer wishing to communicate with the parties whose wants are given in this column can obtain their addresses from this office.

No charge will be made for these services.

We also offer our services to foreign correspondents who desire to purchase American goods, and shall be pleased to furnish them information concerning American goods of any kind, and forward them catalogues and discounts of manufacturers in each line, thus enabling the purchaser to select the most suitable articles before ordering.

These services are rendered gratuitously in the interest of the subscribers and advertisers; the proprietors of the "Engineering and Mining Journal" are not brokers or exporters, nor have they any pecuniary interest in buying or selling goods of any kind.

GOODS WANTED AT HOME.

653. Saw and shingle mill. Michigan.
654. Boiler and engine. Georgia.

655. Engine, 40 or 50 horse power; boiler about 50 horse power. North Carolina.
656. Engine, 200 horse-power. Georgia.
657. Light hoisting engine, with naphtha engine, or with boiler using kerosene oil. Virginia.
658. Engine, 35 horse-power; boiler, 40 horse-power. North Carolina.
659. Turning lathe and molder. Florida.
660. Locomotive, 3-foot gauge, 30-pound rail; road 5 miles long. Georgia.
661. Ore cars with bottom dump of about 6 tons capacity. Georgia.
662. Hand machinery for manufacturing shoes; complete outfit. Georgia.
663. Engine, 80 horse power, automatic cut-off; cylinder about 15 x 24 inches. New Jersey.
664. Ice machine with a capacity of 10 tons. Virginia.
665. Steel rails; 50 to 70 tons of good second-hand steel rails, 30, 35 or 40 pounds to the yard. New York.
666. Locomotive, second-hand, in good condition, saddle tank, 3 foot gauge; cylinders, 7 x 12 or 8 x 14 inches. New York.
667. Iron ore crusher and elevator; capacity, 15 tons per hour. Alabama.
668. Wood-working machinery. Mexico.
669. Gold mills, for use at gold mines. Arizona.
670. Wood-working machinery. Planing mill, resawing machine, molding machine. North Carolina.
671. Electric light plant for 800 to 1,000 incandescent lights. Maryland.
672. Electric light plant, one 30-light arc dynamo, 10 ampères; motor for 112 or 220-volt circuit, one or two horse power; one 50-light incandescent dynamo; one 200-light incandescent dynamo; one 100-light incandescent dynamo. Pennsylvania.
673. Electric light plant, 75 lights, 16-candle power, incandescent. Virginia.
674. Ice plant with a capacity of 5 tons per 24 hours. Virginia.
675. Machinery for hosiery factory. Virginia.
676. Machinery for brick works, capacity, 25,000 per day. Virginia.
677. Engine, 50 horse power; boiler, 100 horse power. Virginia.
678. Corrugated iron. Virginia.
679. Machine for printing wall paper. Virginia.
680. Elevators. Virginia.
681. Water and steam pipe; pumps and water tanks. Virginia.
682. Electric light plant of 300 lights, to be run by water power. Georgia.
683. Boring and turning mill. Georgia.
684. Exhaust steam heater for 50-inch boilers, 16 feet long; exhaust steam pipe, 6 inches; supply pipe from pump, 1½ inches. Kentucky.
685. Corn mill. Tennessee.
686. Machine for sawing slats for crates and orange boxes. Florida.
687. Tank pump complete, with boiler, pipe and fixtures. Florida.
688. Engine and boiler for saw mill. Florida.
689. Driving and matching machine. North Carolina.
690. Engine and boiler, 4 H. P.; also shafting, belting and pulleys. North Carolina.
691. Drill, lathe and patterns for foundry and machine shop. Tennessee.
692. Machine for manufacturing tacks, finishing-nails, small brass fasteners, hinges, staples, etc. Georgia.

AMERICAN GOODS WANTED ABROAD.

641. Mining machinery of all kinds. South African Republic.
642. A typewriter or other process for printing music. Queensland.
644. Refrigerators for household purposes; hard and soft woods. Queensland.
647. Agricultural machinery and farm implements. Tasmania.
649. Nail-making machinery. New Zealand.

GENERAL MINING NEWS.

ALASKA.

Reports are brought out in the San Francisco papers that pay ore, new ledges, etc., have been found in the Bear's Nest, and it is evidently sought to convey the impression that the work which we recently stated had been commenced to prove the property more fully has been successful. This we regret to say has not been the case, and those to whom the favorable reports have come should look into their sources, for it has all the appearance of an attempt to "boom" the concern, and find a new outlet for the stock.

ARIZONA.

PIMA COUNTY.

SILVER BELL.—The purchase price of this mining property, near Tucson, which was bought by English capitalists some time ago, was, it is reported, \$200,000, the syndicate having the privilege, however, of expending \$15,000 in development up to first of May next. For the last three or four months there has been a force of fifty men at work on the mines, it is probable that a smelting plant will be erected. The force now at work is engaged in opening up the property by shaft and

tunnel, and in blocking out the ore, which consists of lead carbonates and high-grade copper.

PINAL COUNTY.

GREAT EASTERN MINING COMPANY.—This company, which was organized in St. Louis last June, for the purpose of operating a group of mines near Casa Grande, A., has been served with a notice through its president, F. W. Smith, that unless the first mortgage notes, amounting to \$24,000, and which are past due, are paid shortly, suit would be brought to foreclose the property. The company have been considering the proposition to lease the mines to the Western World Company for a royalty of 25 per cent., with an option to purchase the Great Eastern for \$1,000,000, and the board of directors have decided to accept the proposition, and the decision of the board has been ratified by the stockholders.

CALIFORNIA.

JULIAN GOLD MINING AND MILLING.—The stock of this company was recently placed in St. Louis, and the financial condition of the company is said to be such as to warrant its sending the superintendent, Mr. F. W. Werlitz, to the mines to push the work.

PLUMAS COUNTY.

TAYLOR PLUMAS MILLING AND MINING COMPANY.—At the recent meeting of the stockholders the statement was made by the President of the company that the property had been sold under judgment and time for redemption had expired, but that the property was in friendly hands, and the foreclosure was only done in order to put the property in such a position as would afford opportunity for raising funds to put it upon a substantial footing. A committee of three stockholders was appointed, consisting of Mr. A. R. Brown, J. A. Macpherson and J. A. Head, to investigate into the company's affairs and submit a plan of reorganization or make suggestions, at an adjourned stockholders' meeting, subject to their call. The committee have power to increase their number.

COLORADO.

SPUR GOLD MINING COMPANY, LIMITED.—This company, which has its main office in London, bought a mine with the name which gave the company its title and some others of J. F. Seymour, Ellen Seymour, and W. G. Pell, for \$750,000. The contract was entered into by the parties in the fall of 1886. The mines were worked for some time, but they did not fulfill expectations, and a suit has been instituted for misrepresentation by the syndicate against the Coloradoans. The latter, to prevent such a suit, filed a counter suit praying for a bill of injunction to prevent the Englishmen from prosecuting their suit. They alleged that the contract had not been fulfilled by the company, and that the mines were as good as they had been represented. This came up for a hearing before Judge Hallett in the United States Court at Denver some two weeks ago, and on the 12th inst. the Judge denied the motion for an injunction.

CLEAR CREEK COUNTY—EMPIRE DISTRICT.

(From our Special Correspondent.)

Gold having been discovered in this camp in the early days of mining in Colorado, it was the scene of the greatest activity of any part of this county in the early '60s. Much of the surface quartz was milled at a profit by stamp mills and arrastras, it being easily obtained, and the gold being very free to amalgamate. On reaching a slight depth in most of the veins, the character of the ore changes, being impregnated with pyrites and the gold much less inclined to amalgamate.

During the last twenty years there have been many attempts, more or less well directed (mostly less) to make these ores pay.

The mines of this district offering the most promise are located on Silver Mountain, forming a complete network for a considerable area. Located under the early laws the claims are largely very small, almost hopelessly in conflict, owned by adverse and not always friendly parties. As was necessary under these conditions operations have been confined to segregated portions of a vein or veins. Mining and milling expenses have been very high, higher than the assay value of the ore in many instances.

What seems to be necessary to successful mining and milling of these ores is:

1. A consolidation of the conflicting claims of each mineral belt.
2. The systematic mining and milling of the ores according to the most approved methods.

There is no doubt that ore exists here in sufficient quantities, of as good a grade and no more refractory than those of other parts of the country, which are being worked at a handsome profit.

There is a movement on foot to accomplish the result outlined above. With what success remains to be seen.

The report that the lessees on the Lamartine had secured an extension of their lease at an increased royalty was unfounded. The owner refuses to lease the mine any longer on any terms.

PITKIN COUNTY.

ASPEN MINING AND SMELTING COMPANY.—It is reported that this company has compromised with W. R. Rust, in the suit pending in Denver, and paid Mr. Rust \$12,000. The suit was originally brought for \$50,000.

DAKOTA.

MINNEHAHA COUNTY.

BLACK HILL ASBESTOS COMPANY.—Application for charter has been made to the Secretary of State. The company has been formed to purchase and operate five claims on Whitewood Creek, about three miles above Pennington. Two of the locations show deposits of asbestos; the three remaining are principally valuable for a good quality of the clay from which fire brick is made. It is stated that the clay has already been put to several practical tests.

INDIANA.

GREEN COUNTY.

It is reported that a vein of bituminous coal has been reached by the drill at a depth of 105 feet at Lenton. A stock company of Welston, O., with a paid-up capital of \$30,000, will operate it. The company has leased many acres of land adjoining, and will drill further.

MICHIGAN.

COPPER MINES.

ALLOUEZ MINING COMPANY.—The annual meeting of this company was held at New York on the 11th inst. The following directors were unanimously elected: Messrs. William C. Stuart, John Stanton, John Banta, Henry R. Treadwell, Joseph E. Gay, Leonard Lewisohn, Albert S. Swords, John R. Stanton and Frederick Smith, the last named being the company's superintendent at the mine. In our last number we gave extracts from the company's annual report.

NATIONAL MINING COMPANY.—The following summary in reference to this mine is condensed from the *Ontonagon Herald*: The large amount of rock which was in the mine has been stamped and the mill is closed down for repairs. Some half-dozen jiggling machines are to be added, so as to treat the increased amount of rock that it is expected will be stamped next summer. About a year's supply of wood will be on hand by the time the mill starts up again. With the exception of the repairs to the mill, no work is doing by the company. Some dozen or more tributaries are at work in the south vein, and it is expected that they will have a fair supply of copper before work is resumed in the spring. There is plenty of rock in the old burrows to keep the mill running night and day for a good many months. The rock in these burrows is rich, as when it is deposited there no attention was paid to stamp rock, mass work being then all that was thought of.

IRON MINES.

Press dispatches dated Ashland March 12th, state that a large strike of miners is in progress in the Gogebic iron range. All the hands in the Norrie mine are idle. A crew of 40 tramway men on the surface struck for an advance from \$1.65 a day, and the mine boss refused to grant the demand, when the new secret organization perfected among the miners showed its hand. Every pick and shovel in every drift in the mine was dropped at the word, and notice was sent to the boss that not an ounce of ore should be sent up until the demands of the trammers had been conceded. The mine manager replied that under no circumstances would he grant the advance. This is the time of the year when the men actually get an advance, and they asked for it as a matter of course. It was the boss' prompt and decided refusal that led the men to expect a long fight. Most of the men in the two mines are foreigners.

(Special Correspondence of H. M. Johnson, Chicago.)

AURORA IRON MINING COMPANY.—It is reported that this company will shortly begin the construction of one or more steel steamships for carrying its ore from Lake Superior to Lake Michigan and Lake Erie ports. The product of the mine this year will be about 300,000 tons.

CROWN POINT.—The Crown Point option, adjoining the Brotherton mine on the west, has recently been purchased by Capt. Jos. Sellwood and others. A narrow vein of ore has been found and will be developed.

MIKADO.—The work of unwatering and developing the Mikado option, near Wakefield, has been resumed.

SUNDAY LAKE.—The legal contest between fee-owners and leaseholders of this mine has kept the property idle for the past two years or more, and it is not likely to be decided in time for active operation this coming season. It will doubtless be carried to the Supreme Court.

MISSOURI.

An English syndicate is buying lands in the different mining districts. The representatives, Captain Roberts, of London, England, and Captain Tamblin, of Detroit, have been in St. Louis in the interests of the company. It is stated that 100,000 acres have been purchased in the country surrounding Potosi. As soon as all the desired lands have been secured work will begin.

JASPER COUNTY.

(From our Special Correspondent.)

JOPLIN, March 10.

The cold weather during the forepart of the week and the bearishness on the part of the ore

buyers have held the ore market down to a much lower figure than was expected, but we are still able to make a creditable showing. The following are the sales for the week ending March 8th: Joplin Mines, 835,970 lbs. zinc ore and 135,820 lead; value, \$12,522.25.

Webb City Mines, 400,920 lbs. zinc ore and 105,570 lead; value, \$7,855.14.

Castroville Mines, 424,580 pounds zinc ore and 52,960 lead, value, \$6,522.25.

Zincite Mines, 240,650 pounds zinc ore, value, \$2,888.40.

Galena, Kans., Mines, 543,540 pounds zinc ore and 35,710 lead, value, \$6,203.16; all districts total value, \$36,181.64.

The most important transaction of the week was the consummating of the sale of the Ruby Mines to St. Louis parties for \$40,000, by Geo. H. Hutchinson & Co.

This is a valuable property located two miles south of the city that has been opened up since last July and has produced over \$13,000 worth of zinc ore up to the time of the sale.

There are many capitalists in the city from New York, St. Louis, and Kansas City.

A. J. Fox and others sold six mining lots on the Granby Mining Co. land to Kansas City parties; consideration said to be \$7,000.

W. D. Charde, secretary of the Kansas City Mining Exchange, arrived in the city Monday morning, and spent the day in visiting the mines. He has just returned from a trip to Colorado, and expresses himself as greatly surprised at the mining resources of this lead and zinc district.

The Diamond Mining Company is opening up very large bodies of ore as the development work is advanced.

The stocks of several lead and zinc mining companies are making arrangements to list on the Kansas City Mining Exchange. This is a move in the right direction, as it can then be seen what dividends can be paid by lead and zinc mines.

The opening of the Kansas City Mining Exchange has been postponed until Monday, March 17th. There will be a large delegation from Joplin to meet the representatives from Colorado, and an invitation will be extended to the visitors from Colorado to visit the zinc mines.

MONTANA.

From a communication from Mr. Thomas G. Merrill, in the Butte *Inter-Mountain*, we condense the following: "The Mineral Land Association of Montana, of which the following are the officers and incorporators—A. H. Mitchell, president; L. H. Hershfield, vice-president; R. O. Hickman, treasurer; Thomas Cruse, A. H. Barrett, B. F. White, Wm. Thompson, J. E. Kanouse, G. A. Wolf, A. A. McDonald, Vining A. Cook—has been incorporated with a capital of \$50,000, shares \$1 each, non-assessable, for the purpose of preventing, if possible, the Northern Pacific Railroad Company from acquiring title to about 9,000,000 acres of the mountainous mineral lands of Montana, of which over 2,000,000 acres, which have been surveyed, are already selected by them and credited to them by the register and receiver of the United States land office. These lands, embracing all the best mining camps of the state, contain several thousand discovered and recorded mining properties that are as yet unpatented, and should the patents to this land be issued to this company it would irrevocably take all these mines from their rightful owners. And the decisions of the courts and the departments are such as to leave us but one possible means to prevent the title to these mineral lands from passing to this railroad corporation, and that is Congressional action. In securing the necessary action from Congress the company have not only the Northern Pacific company to oppose, but the other Pacific roads, as they, too, are claiming the mineral lands, and will combine to prevent the association from securing the Congressional action absolutely necessary to save these mineral lands to the people. The Northern Pacific company is at work in Congress already, and Mr. McNaught, the counsel-in-chief of the Northern Pacific, is making efforts to convince the members of Congress along the Northern Pacific road, and the Montana and Washington men especially, that his road is entitled to the lands within its grant, not specially determined as mineral lands previous to the conformation of the grant. The names of the incorporators are a guarantee to the people that every dollar paid into the treasury will be honestly and faithfully used. If the citizens and mining companies do not furnish this association with sufficient means to pay expenses by becoming interested financially their efforts will have to cease. The mining companies and all the owners of paying mines are deeply interested in this for, according to the decision of Judge Sawyer of the United States Circuit Court in the case of Francour vs. Newhouse, rendered on December 9th, 1889; also the decision of Justice Field in the United States Supreme Court in the district of Oregon, in the case of Denny vs. Dobson, Federal Reporter, vol. 32, page 890, should either of these decisions be affirmed by the Supreme Court of the United States, there is not a mine on an odd numbered section within the limits of the grant to the Northern Pacific Railroad company but what would belong to that company, be the mine patented or unpatented.

DEER LODGE COUNTY.

BI-METALLIC MINING COMPANY.—The company has paid off its indebtedness of \$600,000. Since the

50-stamp mill started up a year ago last February, the company has been earning on an average of over \$50,000 per month over and above expenses, and has been steadily reducing the debt contracted in placing upon the property the necessary machinery. Previous to the completion of the plant, the mine had been producing at the rate of \$40,000 to \$50,000 monthly, which was shipped to Omaha. The mine has been systematically developed. Besides the 50-stamp mill, which has a capacity of 75 tons per day, the company have erected a tramway from the mine to the mill about two miles in length and hoisting works. It is the intention of the company to create a fund of from \$100,000 to \$150,000 before paying dividends. Many of the largest stockholders in the Granite Mountain Mining Company are interested in the Bi-Metallic.

DEER LODGE MINING AND SMELTING COMPANY.—Progress on the Hidden Hand property, owned by this company, is reported to be satisfactory. The incline is in 95 feet, with a ledge five feet between walls, and the pay streak of galena and lead carbonates is 15 inches wide. There is a foot-wall of granite, and the hanging wall is porphyry. Work is being pushed.

GOLD COIN SYNDICATE.—This company, which has just been organized to carry on operations near Hasmark, and controls the Gold Coin, Big Expectation, Mary Ellen, Elizabeth Ann, Michael Devitt, Helena, Needle Gun and Highland Chief. The sinking of a shaft on the Expectation and other development works will be commenced shortly; the men are engaged in grading and building a shaft house, hoist, etc. F. J. Mackey and H. P. Clarke are in charge of the work.

MEAGHER COUNTY.

CUMBERLAND MINING COMPANY.—A site has been surveyed and the ground is now being broken for a new 60-ton smelter to be erected by this company at Castle. The smelter will be completed by July. The ore, which has formerly been hauled to the smelter, will now be carried through tramways from the Cumberland to the new smelter. At the mine sinking is to be continued until the 500-foot level is reached.

GREAT EASTERN.—A three-fourths interest in this mine at Castle has been sold to Len Lewis, of White Sulphur Springs, for \$37,500.

SILVER BOW COUNTY.

ALICE GOLD AND SILVER MINING COMPANY.—The shaft on the Alice mine has reached a depth of 1,217 feet. Before continuing deeper a station will be cut at the 1,200 mark, after which sinking will be resumed and continued until the depth of 1,300 is reached. At present ore is being taken from the 1,000-foot level. The large mill is crushing ore from the company's mines and also from leases in the neighborhood. In addition to other improvements recently made about the mine, a new tramway has been built south from the hoisting works, from the end of which all waste taken from the mine is dumped.

Mr. William A. Clark has begun suit against this company for \$15,000 damages. The plaintiff claims that for six years he has been owner of, and in possession of, the Clark's fraction quartz lode mining claim at Walkerville, comprising 240-100 acres. The defendant during the same period has been owner of the Magna Charta claim. The latter claim is situated east of and adjoining Clark's fraction. The plaintiff claims that on repeated occasions since March 15, 1888, by means of drifts and levels running from the west end of the Magna Charta, at a depth of 200 feet from the surface, the Alice company entered Clark's fraction lode claim at the eastern end. By means of drifts, levels and the slopes, at the depth of 200 feet, the defendant is charged with having mined, extracted, taken out and carried away from beneath the surface 300 tons of gold and silver bearing quartz ore, rock and earth, of the value of \$50 per ton.

COLORADO SMELTING COMPANY.—This company contemplates enlarging its works, in addition to the new matte furnace which is now fast nearing completion. This company is shipping about four cars of copper-silver matte from Butte weekly, the ores being procured from the Gagnon, Nettie, Burlington and others.

MOULTON MINING COMPANY.—This company has lately been sinking a winze on the 700, about 300 feet from the station, and has stopped at a depth of 115. It was surmised that adjoining companies had been working on its ground, and this was the mode of ascertaining if such was the case. There is still considerable ore yet in reserve in the many stopes of this company, but it is stated it will not be long before the shaft will have to be sunk to a much greater depth if they intend to work the large mill on ores from this property.

NEVADA.

ESMERALDA COUNTY.

MOUNTAIN QUEEN MINING AND MILLING COMPANY.—This company has filed articles of incorporation with the Secretary of State. Place of business, Candelaria, Nev.

STOREY COUNTY—COMSTOCK LODGE.

VIRGINIA STANDARD MINING COMPANY.—This company has recently been formed to work the

Virginia Standard mine, located in Sevenmile Canyon, 1,000 feet south of the Keyes mine. There is a tunnel on the property 140 feet in length. The work of development will be vigorously prosecuted. Mr. P. J. Keyes is the superintendent.

WASHOE COUNTY.

The reduction works at Reno, which cost over \$75,000 located at Truckee River, one mile east of Reno, were destroyed by fire on the 12th inst.

NEW MEXICO.

GRANT COUNTY.

MIMBRES CONSOLIDATED MINING COMPANY.—The company's mill near Georgetown will shortly be started up for the summer. This mill has been closed down since last fall, and a large amount of ore has accumulated on the dumps. The capacity of the mill is greater than the output of the mines, but new ground is being opened and the manager is trying to increase the output, so that, by the time the surplus ore which is now on the dumps is milled, the mines will be producing enough ore to keep the mill constantly at work.

NORTH CAROLINA.

HOWIE.—This mine is about to erect two more Wiswell mills. For nearly four years two of these mills have been in successful operation at this mine. These mills are made by the Wiswell Electric Mining Machinery Company, of Boston, Mass.

OHIO.

SUNDAY CREEK COAL COMPANY.—According to reports negotiations are in progress for the sale of this company's plant. An English syndicate is said to be so far the highest bidder. The company controls and owns 15,000 acres of coal territory. Representatives of an English syndicate have, it is stated, recently been examining the Ohio coal fields with a view of buying the mines and thus controlling the output.

PENNSYLVANIA.

COAL.

LEHIGH AND WILKES-BARRE COAL COMPANY.—The fire in the South Wilkesbarre shaft at Wilkesbarre, to which we referred in our last issue, it is said has been extinguished, and the pumping process has been stopped. The water will be allowed to remain in the mine for a week, at the end of which time the strata will be sufficiently cooled to prevent another outbreak of fire.

It is said that John P. Rea, Master Workman of the United Miners, will prosecute the company for criminal negligence in causing the death of the eight miners in the Nottingham mine, Plymouth, February 1st.

PENNSYLVANIA COAL COMPANY.—The company had resumed work the 10th inst. at the Barnum shaft at Pittston, after a short suspension, owing to some accident of the machinery, and owing to the explosion of one of the boilers in the nest which supplies steam for the hoisting engine, and work at the colliery had to be suspended for another week.

NATURAL GAS.

GREENSBURG FUEL COMPANY.—The Brown gas well, which situated near Grapeville, and known as Brown well No. 2, owned by this company, had become obstructed with crystallized salt, was drilled deeper, and is now producing more gas than ever before.

OIL.

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, 1890, and during the eight months ending February 28th, 1890, as compared with similar exports during the corresponding periods of the preceding months as follows: February, 1890, \$3,139,123; February, 1889, \$3,509,479; eight months ending February 28th, 1890, \$35,435,086; eight months ending February 28th, 1889, \$33,441,979.

Exports of refined, crude, and naphtha from the following ports, from January 1st to March 7th, were as follows:

	1890.	1889.
	Gals.	Gals.
From Boston	376,662	622,635
Philadelphia.....	1,136,249	20,796,832
Baltimore.....	1,202,454	2,013
Perth Amboy.....	760,087	2,021,446
New York.....	67,459,831	74,682,455
Total exports.....	86,636,183	98,132,431

VERMONT.

ORANGE COUNTY.

COPPERFIELD MINING AND SMELTING COMPANY.—The copper mines of this company at Ely have been pumped dry and the old supports supplied by new timbers. Mr. Otto A. Krause, of New York, is largely interested in this company. The property is to be examined by an expert and if he reported favorably a large force will be employed.

ELIZABETH MINING COMPANY.—A large vein of copper parallel to the old one has been discovered at Stratford and will be worked by this company.

VIRGINIA.

VIRGINIA TIDEWATER COAL COMPANY.—An injunction has been granted by Judge Andrews in Supreme Court, New York, this week, in the suit of this company against the Mercantile Trust Com-

Sutter Creek awoke from its lethargy on Thursday, and advanced from \$1.60 to \$1.80. Sales amounted to 9,700 shares. Another "spurt" is said to be under way, but if we are to be guided by the reaction which took place after the last advance, speculators are naturally cautious in touching the stock. Large sales continue to be reported in Astoria. It is stated that the ownership of this property has changed hands. Whether this statement is made to disguise the operations of the former promoters of the company it is as yet impossible to say. The comparatively large sales that are reported in the stock strengthens the impression that they are made in order to attract the attention of investors who think that this activity fortells a boom more readily than they would if the shares were offered for subscription.

The promoters of the Amador stocks are still holding back Middle Bar and Amador which again show no quotations this week.

The Bodie stocks seem to have disappeared from the list entirely at present.

Plymouth Consolidated shows no transactions. Holyoke shows a few sales at 4@6c.

The business in Freeland was not quite as large as during the past two weeks; nevertheless it amounted to 21,500 shares. The price in the beginning of the week declined from \$1.20 to \$1, but later on advanced to \$1.50, selling to-day at from \$1.10@ \$1.15. Aspen shows a sale on last Saturday at \$9, and to-day at \$9.25. Some 410 shares changed hands. The dividend of 10 cents per share will be payable to-morrow.

Breece is quiet at 4c. and 45c. Only one sale of Leadville is recorded at 11 cents. Little Chief shows a few sales in the beginning of the week at 30c. and 31c., but nothing has been done in this stock since Tuesday. Adams is quoted at \$1. La Crosse was active at 7 cents. Small Hopes sold at \$1.05. On the whole the market in Colorado stocks has been flat.

Ontario holds its own at \$40 and \$40.50. Since the stock has advanced to this high figure there is more business in it than there was when it was quoted at \$30. The favorable condition of the Horn Silver Mining Company has created quite a demand for this stock, and keeps the price firm with an upward tendency. It went this week from \$2.45@ \$2.60.

Mutual Smelting and Mining Company was steady at from \$1.60 to \$1.65.

The copper stocks have disappeared from the list at present. Very little is doing at any time in these stocks in the New York market.

El Cristo was a little more active and advanced from \$1.40 to \$1.50.

It does not seem to be possible for Rappahannock to rise much above five cents. This stock, which a year ago, showed daily transactions, appears now scarcely more than once a week.

Silver Mining of Lake Valley shows a business of 1,000 shares at 35@40c.

Homestake, which has been neglected for some weeks past, shows one sale at \$3.75. Caledonia is down to 30 cents. Deadwood Terra, Iron Hill and Father de Smet were not dealt in.

Phenix of Arizona continues to be in demand and again shows large transactions. The price has been firm at from 79 to 85 cents. Silver King was quiet and declined from 45 to 40 cents.

The constant flow of assessments on the Comstock Mining Company's shares seems to have killed all interest in these stocks. They are neglected in this market and prices show but little change from week to week. Consolidated California and Virginia went from \$4.75 to \$4.40; Gould & Curry was firm at \$1.50; Hale & Norcross went from \$2.60 to \$2.30; Ophir sold at \$3.80; Savage at \$1.55 to \$1.65; Yellow Jacket at \$2 to \$2.10; Alta, \$1.35; Bullion at 70c. Chollar advanced from \$2.25 to \$2.35 and later declined to \$2.15. Julia is quoted at 30c. Mexican was one of the most active Comstock stocks and advanced from \$3.10 to \$3.35, declining, however, on Wednesday to \$2.95. Occidental sold at \$1.20, and Utah at from \$1.60 to 75c.

Comstock Tunnel stock, in which no business has been done for several weeks, sold at 17 and 18 cents. The bonds were quoted at \$30.

The Tuscaroras are neglected; the only sales recorded were in Navajo at 30 cents. North Belle Isle, \$1.25.

Boston. March 13.

(From our Special Correspondent.)

During the early part of the week, the market for copper stock maintained its characteristic dullness, and prices were barely sustained. The past three days, however, an entire change has come over the scene, and dullness has given way to an activity which is encouraging to holders of stocks as well as to the brokers who buy and sell them. The easy condition of the money market has, doubtless, had somewhat to do with it, but the increased and increasing demand for ingot copper, and the outlook generally for business has stimulated speculation in this class of stocks, which have always been favorites in this market, and we look for greater activity and much higher prices as the season advances. The demand for C. & H. has advanced the price to \$260, a gain of \$6; and very little stocks comes out even at this price.

Tamarack sold up to \$10, dividend (\$3) on. now selling at \$158, ex dividend, and in good demand.

Quincy declined to \$83 in early dealings, but

rallied and touched \$70 with a fair amount of sales.

Boston and Montana steadily advanced from \$45½ to \$49¼, and there is a growing demand for it, which may push it up again well into the seventies.

Oscocla has been very active with sales the past three days, aggregating over 3,000 shares, advancing from \$26½ to \$30½, the highest price of the year. Its friends predict \$50 for it this year.

Franklin started into activity again and from \$13½ sold up to \$15½ without bringing out much stock.

Keearsarge advanced from \$9½ to \$10½, and is looked upon as one of the coming features of the market.

Butte & B. is getting to be quite a factor in the market. Sales, 2,500 shares, with an advance from \$14½ to \$15½.

Atlantic also scored an advance from \$13½ to \$14.

Centennial is about the only stock on the list which is selling below prices of last week. It declined from \$25 to \$23, with later sales at \$25.

Allouez is quite firm, advancing from \$2½ to \$3½, selling, however, later, at \$2½.

Santa Fe was a little stronger to-day, and sold up to \$1.05. 97½c. seems to have been bottom price for this stock, and it is no doubt a purchase for a good advance from present price.

Huron is looking up again, selling at \$3½. National sold at \$1½. Bonanza at 85c.@90c., and Arnold at 35c., assessment of 10c. per share paid. With the improvement in the general list we look for a revival of interest in the low priced copper stocks, and purchases made now will doubtless show handsome profits in the near future.

Silver stock quiet, Napa quicksilver sold at \$5. Catalpa 20c.@25c., Breece at 40c. We hear of sales Dunkin at 60c. outside the board.

By Telegraph.—Quincy, \$72; Franklin, \$15½; Oscocla, \$30@31½; Boston & Montana, \$49½@50½; Keearsarge, \$10½; Centennial, \$24; Butte & Boston, \$15½; Atlantic, \$14.

Denver.

Prices and sales during the week ending March 8th:

Company.	Open-ing.	H.	L.	Clos-ing.	Sales.
Alleghany, Colo.	29	31	28	28½	12,800
Amity, Colo.	17	18	15	15½	14,500
Bangkok C. B., Colo.	32	32	30	30½	1,300
Bates Hunter, Colo.	21	23	21	21	117,600
Brownlow, Colo.	42	45	39	45	24,700
Calliope, Colo.	45	48	43	44½	2,300
Clay County, Colo.	43	43	41	40½	1,500
Hard Money, Colo.	15½	18	13	17	21,800
Little Ruler, Colo.	50	53	50	50½	10,400
Matchless, Colo.	1.26b	1.50b	1.00b		
May-Mazepa, Colo.	1.16	1.16	1.15	1.16	30,300
Mollie Gibson, Colo.	50	50	50	72½a	400
Oro, Colo.	4.25	4.25	4.00	4.00b	1,600
Pay Rock, Colo.	10	11	10	11	74,200
Puzzler, Colo.	25	29	24	24½	10,600
Silver Cord, Colo.	54	54	43	45b	600
White, Colo.	36b	40	37	37	12,800

Company.	Open-ing.	H.	L.	Clos-ing.	Sales.
Aspen Mutual, Colo.	20	22	12		172,200
Big Indian, Colo.	37a	40	33	36	11,800
Big Six, Colo.	24b	27	24	21	4,400
Claudia J., Colo.	09	10	08	09	8,000
Diamond B., Colo.	15	120	15	16	21,800
Golden Treasure, Colo.	21b	22	20	21	11,100
Ironclad, Colo.	09½	11	09½	10	38,600
Legal Tender, Colo.	08	10	08	08½	10,600
Morning Gum, Colo.	43b	45b	42	45b	17,100
Natural Gas & O. Co.	24	20	2	2	92,600
Potosi, Colo.	32b	34	31	31b	7,200

Total for the week..... 731,600
 *Buyer 30. †Buyer 60. ‡Seller 60. §Seller 30.
 a Asked. b Bid.

St. Louis.

The stock of the Consolidated Coal Company dealt in in St. Louis declined from \$44 to \$39 last week. This break is due to the passing of its March dividend of one per cent., which is payable quarterly. The open winter and a marked falling off in the consumption of coal is said to be the cause. The stock of Southern Queen Gold and Silver Mining Company, of Arizona, was called for the first time last week, and received bids of 7½c., being offered at 20c. seller 30 days, later 10c. was bid and no stock offered. The subscription price for the stock was 11c.

A sale of the stock of the Bi-Metallic Mining Company of Montana is recorded at \$28.50. This sale is worthy of notice, as it is the first transaction ever made in this stock on call. It is expected that there will be considerable business in the city owing to the company's favorable condition.

The question as to who was responsible for the assessment on the stock of the Tourtelotte Mining Company of Colorado sold prior to the levying of the assessment, deliverable in 30 days, and upon which there was a diversity of sentiment, early in February, when a number of such sales were made, has been decided by the board of directors of the Mining Exchange, to whom it had been left, so that all stock so sold and delivered on or before the 23th constituted good delivery, and those who purchased such stock must receive it, assessment unpaid.

Lake Superior Iron and Gold Stocks.
 (Special Report by David M. Ford, Houghton, Mich.)
 NEW YORK, Friday Evening, March 10.

Iron Stocks.—The prevailing dullness which has extended over a large part of the country, among the manufacturers of iron and in the

manufactured product, has had a slight depressing effect on the value of some of the iron stocks, although there is still a good demand for the best iron stocks and also quite a large demand for the lower priced stocks and stocks of new mines and developments. At the same time, when these stocks are wanted they are very hard to find, being in the hands of men willing to hold them, and who anticipate a brisk demand and advance within the next 60 to 90 days. In the whole Lake Superior district there is great activity among all the producing mines, as well as a great deal of work being done in the development and opening of new mines, with the idea of making them producers this year. The effect of this all will be that the Lake Superior iron district will produce much more iron this year than ever before. A large part of the output has already been sold, and the mine-owners have no fears but what they will be able to sell at good prices all that they can produce. Quotations for these stocks are published below.

Gold Stocks.—The prevailing dullness and tightening up of money has a depressing effect on the gold stocks, together with the fact that we have had such remarkably cold weather, the thermometer down as low as from 33 to 42 degrees below zero, with snow all the way from four to seven feet in depth. This has interfered with the prosecution of work at the gold mines, as well as with business generally in the northern peninsula. Again, when these mines were first opened, considerable stock was sold at a low figure to start the mines. This stock was distributed among a very large number of small holders. These parties are many of them seeking to realize on their stock, and have been throwing it on the market at below its actual value. A large amount of this stock has been bought by permanent investors who do not care to sell at any price, but until the floating stock of these small holders is picked up and laid away, prices will be unsettled.

The out-put of the Ropes mine for the last year is estimated to be a little over \$100,000, and the total yield for the mine since starting, has shown by actual returns from the mint in gold \$242,705. 01, silver \$2,579.40, a total of \$248,485.41. In addition to this there should be added several car-loads of concentrates from which the returns have not been received, from an estimate, as per assays, of \$4,628, which will make a total yield of about \$273,125. This company contemplates adding more stamps and machinery to its plant during the present season, which will increase the output very largely at comparatively small expense, and it is expected that the profits for the coming year will not only pay for this additional machinery, but will also pay a dividend. At the Michigan gold mine the small mill was run during the month of February on the lowest grade rock, of which 150 tons was milled. A clean up was made at the end of the month, the amalgam retorted, the yield in gold being \$3,581.90, and the silver \$30.60; a total of \$3,612.50, making the value recovered per ton of rock, \$24.08. The loss in tailings per ton in gold, \$3.40; loss of tailings per ton of silver, 12 cents; total, \$3.52; making a total from the rock treated \$27.60. An average of 7½ tons of rock was run through the small mill per day. The loss in tailings seems to be high, and this can undoubtedly be remedied by using concentrators, of which the mill has none at present. For the months of January, only part of the month, and February, the Michigan gold mine produced gold, \$12,796.26; silver, \$59.08; total, \$12,855.34. At the other gold mines work is being prosecuted in the way of prospecting and preparing for spring work with as much vigor as is possible during this extremely cold weather.

GOLD MINING STOCKS.

Name of Company.	Par value.	Lowest.	High.
Gold Lake M. Co.90	\$1.00
Grayling Gold & Silver Co.	\$25.00	.90	1.00
Michigan Gold Co.	\$2.50	3.50
Penninsula Gold & Silver Co.	25.00	.75
Ropes Gold & Silver Co.	25.00	2.25

IRON MINING STOCKS.

Name of company.	Par value.	Bid.	Asked.
Ashland Iron Co.	\$25.00	\$65.00
Aurora Iron Co.	7.50	8.00
Champion Iron Co.	\$100.00	110.00
Chandler Iron Co.	25.00	41.00
Chapin Iron Mining Co.	25.00	33.00
Chicago & Minn. Ore Co.	100.00	125.00
Cleveland Iron Co.	25.00	21.00
Germania	25.00	12.00
Jackson Iron Co.	25.00	125.00
Lake Superior Iron Co.	25.00	65.00
Milwaukee Iron Co.	25.00	6.00
Minnesota Iron Co.	100.00	84.00
Montreal Iron Co.	25.00	8.00
Norrie (Metropolitan)	25.00	75.00
Odsanah Iron Co.	25.00	20.00
Pittsburg Lake Angeline Co.	25.00	170.00
Republic Iron Co.	25.00	50.00

PIPE LINE CERTIFICATES.

(Specially Reported by Messrs. WATSON & GIBSON.)

Petroleum was quite weak, and promises to go lower. The exports of illuminating oil in January of this year were 30,768,000 gallons, against 40,702,000 for the same month last year. The Russian article is finding a wider market in Europe, where receipts of it have largely increased, and the production of the Pennsylvania field has been ap-

preciously increased. The most disturbing factor, however, is Ohio crude. The Standard as advanced its price from 15 cents to 23 cents, said to be on account of the competition of outside buyers. We have had submitted to us at different times—one so recently as today—methods of refining Ohio oil. There is not the slightest doubt of the ability of chemists to refine it so as to deodorize it and make a perfect high-grade illuminating fluid. The only question is the percentage obtained; but we are assured that now 75 to 85 per cent. of burning oil can be secured. This is not far below the proportion taken from the Pennsylvania crude, and in this connection it should not be forgotten that certificates dealt in on the exchanges cover chiefly the old black sand product, deteriorated by age. The new white sand oil commands a premium of 20 to 25 cents per barrel over certificate oil.

NEW YORK STOCK EXCHANGE.					
	Opening.	Highest.	Lowest.	Closing.	Sales.
Mar. 8.....	94 $\frac{1}{2}$	95 $\frac{1}{2}$	94 $\frac{1}{2}$	95	49,000
10.....	95 $\frac{1}{4}$	95 $\frac{1}{4}$	93 $\frac{1}{4}$	93 $\frac{1}{2}$	151,000
11.....	93 $\frac{3}{4}$	93 $\frac{3}{4}$	93	93	58,000
12.....	93	93 $\frac{1}{2}$	93	93 $\frac{1}{2}$	76,000
13.....	93 $\frac{3}{4}$	93 $\frac{3}{4}$	90 $\frac{3}{4}$	91	205,000
14.....	90	90 $\frac{1}{2}$	89 $\frac{1}{4}$	89 $\frac{1}{2}$	68,000
Total sales in barrels.....					637,000
CONSOLIDATED STOCK AND PETROLEUM EXCHANGE.					
	Opening.	Highest.	Lowest.	Closing.	Sales.
Mar. 8.....	95	95 $\frac{3}{4}$	94 $\frac{1}{2}$	94 $\frac{1}{2}$	57,000
10.....	94 $\frac{1}{2}$	94 $\frac{1}{2}$	92 $\frac{1}{2}$	93 $\frac{1}{2}$	151,000
11.....	93 $\frac{3}{4}$	93 $\frac{3}{4}$	93 $\frac{1}{2}$	92 $\frac{1}{2}$	143,000
12.....	93 $\frac{3}{4}$	93 $\frac{3}{4}$	92 $\frac{1}{2}$	93 $\frac{1}{2}$	120,000
13.....	93	93	90 $\frac{1}{2}$	91	308,000
14.....	90 $\frac{3}{4}$	90 $\frac{3}{4}$	89 $\frac{1}{2}$	89 $\frac{1}{2}$	258,000
Total sales in barrels.....					1,037,000

COAL TRADE REVIEW.

NEW YORK, Friday Evening, March 14.
Statistics.

Mr. John H. Jones, chief of the Bureau of Anthracite Coal Statistics, furnishes us the following statement of shipments of anthracite coal (approximated) for the week ending March 8th, 1890, compared with the same period last year:

Regions.	March 8, 1890.	March 9, 1889.	Difference.
Wyoming Region-Tons	232,012	269,020	Dec. 37,668
Lehigh Region ..	77,714	91,489	Dec. 16,775
Schuykill Region. "	181,804	119,876	Inc. 11,928
Total.....	441,530	480,385	Dec. 41,855
Total for year to date..	4,672,476	5,252,412	Dec. 575,934

PRODUCTION OF BITUMINOUS COAL for week ended March 8th and year from January 1st:

EASTERN AND NORTHERN SHIPMENTS.			
	1890.		1889.
Tons of 2,240 lbs.	Week.	Year.	Year.
Phila. & Erie R.R.....	1,656	27,385	15,501
Cumberland, Md.....	58,448	720,369	525,021
Barclay, Pa.....	3,219	24,521	27,003
Broad Top, Pa.....	10,309	108,838	84,306
Clearfield, Pa.....	73,339	790,762	617,138
Allegheny, Pa.....	20,320	211,155	171,310
Beach Creek, Pa.....	40,738	346,191	269,551
Pocahontas Flat Top.....	25,638	331,146	287,926
Kanawha, W. Va.....	48,272	354,293	323,621
Total.....	282,094	2,914,660	2,324,377
WESTERN SHIPMENTS.			
Pittsburg, Pa.....	17,194	169,206	121,400
Westmoreland, Pa.....	43,667	356,288	317,244
Monongahela, Pa.....	3,248	44,346	30,434
Total.....	64,109	569,840	469,078
Grand total.....	326,503	3,484,500	2,793,455

PRODUCTION OF COKE on line of Pennsylvania R. R. for the week ending March 8th, and year from January 1st, in tons of 2,000 lbs.: Week, 90,222 tons; year, 1,057,926 tons: to corresponding date in 1889, 859,582.

Anthracite.

The treachery of the weather clerk has now established the fact that he is no friend of the anthracite coal men, and it was in a not altogether pleasant state of mind that the sales agents of the different companies convened on the 13th inst. As usual, nothing of importance transpired. The present demoralized condition of the trade was discussed at length, and many suggestions were offered for its improvement, but no decisive steps were taken. When the needs and conditions of the market are so well known, it is indeed strange that such an intelligent and well-informed body of men, as are the sales agents of the different companies, cannot agree upon some plan of action that would inspire the confidence of buyers and create a fair demand. It is not so much a question of higher prices as it is a market for an increased output, and until the stocks show signs of exhaustion, we cannot understand why some of the producers should favor the idea of putting out more coal than heretofore. Pea and buckwheat continue in good demand, though orders are not so urgent as recently; the prices of stove and chestnut are still shaded, and will undoubtedly continue to be so, as consumers do not care to lay in a supply at any figure when there is such a poor market for these sizes. Prices remain as last quoted; Broken, \$3.40; egg, \$3.50; stove,

\$3.60@3.70; chestnut, \$3@3.25, and pea coal is selling at \$2.80, f.o.b., or \$3 alongside.

A matter of no little importance to the coal trade generally, but more particularly to the bituminous, is the remarkable advance in the prices of coal in Europe. Within the past twelve months coals for domestic purposes have more than doubled in value, while gas coals which could be readily obtained a year ago at \$1.50 per ton at the mine are now in eager demand at \$3.75, and even more. There is only one reason to account for this phenomenal rise in value, and it is that the demand is far in excess of the supply; in fact, statistics at our disposal show that over 30 per cent. of the inquiries for coal received by English operators last year were not satisfied, though the mines were in full operation, and many thousand extra men were steadily employed throughout the year. Nor has this shortage of stocks been caused by strikes, for the producers have uniformly granted all requests for an increase of pay, and coal miners in Great Britain are at the present time receiving higher wages than ever before. Further evidence that Great Britain's capacity of supply has nearly reached its maximum is given in the fact that Germany imported far less coal from Great Britain in 1889 than it did in the previous year.

The industrial conditions of Europe, as we have before remarked in these columns, have undergone a considerable change within the past few years, and as they will undoubtedly continue to develop, the consumption of fuel will be greater and greater each year, until possibly the price of coal may reach such a figure that American operators can compete in European ports. The changed conditions of the European coal industry will certainly enable us to establish a trade with South America and the West Indies, the effects of which can hardly be overestimated.

As a result of the Philadelphia & Reading Railroad's new order, refusing to accept four-wheel coal cars, which went into effect the 10th inst., neither the Lehigh Valley nor the Central Railroad of New Jersey delivered any coal to either the North Pennsylvania or East Pennsylvania branches of the Reading Railroad. All the coal which the Lehigh Valley Railroad had in its yards at Packerton consigned to Philadelphia parties was hurried to the Reading tracks before midnight on the 9th. The Lehigh Valley Company is sending all its gondola or eight-wheel coal cars to the mines now.

The New York Retail Coal Trade.

The Retail Coal Exchange of New York held its regular semi-monthly meeting at its Twenty-third street rooms on Friday evening, 7th inst., with Vice-President McMonagle in the chair. The following is an abstract of the proceedings:

The minutes of the last meeting were read and approved. The trustees stated that they were not yet ready to make a report, but the chairman of the Board reported progress, and stated that a meeting of the Board would take place Friday night, 14th inst.

Mr. Theodore S. Mize, the representative in this city of the Chicago *Black Diamond*, was proposed for honorary membership.

It was moved that a committee of four members be appointed for the purpose of making arrangements for the annual excursion.

The committee was empowered to confer with a similar committee from the Brooklyn Coal Exchange in order that both may work together.

No other important business being on hand, the meeting then adjourned.

Bituminous.

The situation in the soft coal trade is unchanged. What would have been considered a large business some years ago is being done. Reports of several large orders having been placed in the East have reached us, though we have not been able to verify them. The operators in New York are taking all orders that come in their way at prices not always in accordance with the new pool agreements. We no longer hear complaints of a shortage of cars, and the railroads have no doubt increased their facilities or else the needs of the trade are not quite so urgent. Considerable new territory is being opened, and there is a feeling of uneasiness among the operators lest this should tend to bring about the reduction of prices which they have been endeavoring to avert.

Chicago. March 12.

(From our Special Correspondent.)

Anthracite.—The close of the phenomenal winter of 1889 and 1890 leaves Chicago merchants in the coal industry, to say the least, depressed. They claim they have suffered to a far greater extent from the continued depression than others in the business located in any other city of the union. The trade, however, is not greatly overstocked, as might be supposed. The feeling among its members seems to be hopeful. Prices have reached bed-rock figures, and will probably remain there for some time. All say there is nothing new to report. The last quotation card of the Chicago Coal Exchange stands posted blank.

The all-round price for anthracite, at retail, we quote at \$6 per ton.

For large and small egg we quote at \$4. Range and chestnut at \$4.75, on dock; on wheels, 25 cents additional.

Bituminous.—Standard Erie we quote at \$4.40, Illinois at \$2.50, Hocking at \$3.50 and Hocking nut at \$3.25 per ton. All in yard to city dealers. Others not quotable with any certainty.

Boston. March 13.

(From our Special Correspondent.)

The telegraphic advices from New York to-day, that the sales agents of the anthracite companies had adjourned for two weeks without taking any action on prices, was a disappointment to many. There is a little inquiry here, and if prices had been made it is thought that there would have been some buying, but now only pressing wants will be supplied. F.o.b. prices on anthracite are very low, running from \$6.80 to \$3.70 on stove, with a possibility that a desirable order would find a range even more in buyer's favor. Broken and egg range from \$3.40 to \$3.55 f.o.b. at New York.

Bituminous coal is still active. Contracts are being closed every day, and by the first of April there will not be much, if any, large business left. The Pacific Mills are reported as having bought, and as they have rejected, or rather refused to entertain any f.o.b. bids, there is a good deal of curiosity to see what member of the pool has secured the contract. Most contracts are, however, being made on delivered terms, and the pool is a virtual nonentity. There is a good deal of scolding about the railroad companies which are alleged to have demoralized the soft coal trade, but all the leading shippers are meeting their competition. A few of the conservative operators are insisting on \$2.50 f.o.b., but they are doing very little business, and admit that they can do nothing until the great grabbers have their clutches full to the dropping point. They draw some consolation from the fact that the patient waiters were not the losers last season, but, on the contrary, managed to do fairly well. Much will depend this year upon freights, for there seems to be more coal sold on a delivered basis than at any time for several years.

Freights at present are low. I hear of 65 cents from New York and \$1.05@1.10 at Philadelphia. Baltimore rates are \$1.20, but will go off if the rates at the other ports keep down.

Retail trade is dull and dealers are not happy. The prospect of bituminous coal competition at cut rates is the most important matter in the retail trade. The bituminous jobbers who have taken a yard here and purpose to retail Pocahontas coal are Curran & Burton, not Castner & Curran, as stated last week. Mr. Curran is reported as saying to a local reporter here since my last letter that they have not sold any bituminous at retail from their new yard as yet but that they most certainly intend to do so. Curran & Burton claim that Boston retailers would not handle Pocahontas coal, and state that their object in going into the business is to introduce the coal to the retail trade. While disclaiming any express intention of cutting rates, they say that they are going to sell the coal, the intimation being that the matter of price will not stand in the way. It further develops that while they do not propose to sell anthracite coal at retail, still "their teamster" has taken the anthracite pockets at their wharf, and is "going to try to make a dollar." Altogether, the members of the retail combination have something diverting, though possibly not serious, to engage their attention. Already the wharf price of bituminous has been reduced 50 cents per ton.

The receipts of coal at this port for the week are as follows:

	For the week—		For the year—	
	1890.	1889.	1890.	1889.
	Tons.	Tons.	Tons.	Tons.
Anthracite.....	16,155	7,206	132,639	123,567
Bituminous.....	17,943	18,363	137,377	132,979
Total.....	34,098	25,569	270,016	256,546

Buffalo. March 13.

(From our Special Correspondent.)

"You can write nothing new about the anthracite coal trade," says a mine owner and dealer. He was quite right. The cold weather has disappeared, and yesterday was warm enough for the putting on of summer garments. Until the spring schedule of prices is announced it is not likely that any wholesale trade will be done.

Invitations have been sent out to contractors to bid on or before the 20th inst. for the grading and masonry of 94 miles of the new Buffalo & Geneva Railroad, from Geneva to Grimesville: the line from that place to outside our city limits, say six to seven miles, is now under construction and will be finished by next fall.

Bituminous coal is fairly active and firm at unchanged quotations. Supply about adequate for all the requirements of trade, with little or none to railroad side track and pay demurrage on.

The Buffalo Car-Service Association will shortly enlarge its field of operations by establishing branches at our neighboring points, viz.: Rochester, Lockport, Batavia, Niagara Falls and Suspension Bridge, all to report to the Buffalo manager, Mr. Van Etten, his clerks attending to all the detail work. Yesterday the first monthly meeting of the directors of the association was held; delegations from the coal, lumber, grain, flour, etc., interests were present in full force on the demurrage question.

The Western freight agent of the Lackawanna Transportation line says the report "that packages and miscellaneous articles will not be car-

ried on its lake propellers next season" is incorrect. The boats will continue the package freight trade to and from Buffalo and Chicago and Milwaukee, and probably Green Bay.

Mr. Scott, of Erie, Pa., has purchased large tracts of land with water frontage at that port for the erection of coal and ore docks, trestles, etc. "His chief end is to concentrate his coal business and evade the high freights imposed upon all shipments to lake points outside of Pennsylvania," says a gentleman supposed to be posted on the matter. "On all such shipments he finds himself on equal footing with other dealers, but the Interstate law does not apply to shipments within the State. Mr. Scott's relations with the Pennsylvania Railroad and Pennsylvania Company will therefore enable him to bring coal to Erie from his mines near Pittsburgh at rock bottom rates; it will then be forwarded by water." Ore and some grain will be handled on the return trips.

The railroads from the Pittsburgh coal fields to the lakes are again complaining that the Ohio coal roads have an advantage in the coal traffic by their differential rate from the Hocking valley. It is not likely, however, the Ohio coal roads will concede any reduction of the differential, even at the risk of a rate war.

It is reported that the Delaware and Hudson Canal Company is making preparations to withdraw its yard and business from the lake port of Sandusky, and also from Cleveland. The cause is stated to be that the natural gas is so extensively used in the territory supplied from Sandusky that the coal has been nearly driven out of the market.

The opening rate for lake freight on coal from Buffalo to Chicago will be about 60c. per net ton—say the wise men along our docks.

The attempt of the commonwealth of Pennsylvania to confiscate the mining lands of the Erie road in Elk County has failed, the Supreme Court holding that the no-forfeiture clause applied to the constitutional provisions that railroad companies shall not engage in mining.

Pittsburg. March 13.
(From our Special Correspondent.)

Coal.—The situation remains about the same as last week; the Ohio is again in good boating order; to-day's shipments amount to 3,000,000 bushels, which will be increased during the week.

The nominal prices are:
Per 100 bushels. 3d pool.....\$1.75
1st pool.....\$1.75
2d pool.....\$1.50
4th pool.....\$1.25
Railroad coal, \$5.20@5.50.

Coke.—The demand continues good, although shipments have been greatly reduced, mainly owing to the inability of railroads to move the traffic. The Pennsylvania Railroad is practically blockaded to the eastward, which greatly interferes with the supplying furnaces east of the mountains. Works are running five days per week; prices remain unchanged; week's shipments aggregate 6,250 cars, decrease from previous week, 320 cars. Shipments to points west of Pittsburgh decreased 336 cars; shipments to points East increased 128 cars; shipments to Pittsburgh fell off 170 cars. Output for the week, 111,708 tons.

Current rates: Furnace f.o.b. on cars at works, \$2.15; Foundries, \$2.45; Crushed, \$2.65. Freights show no change. Pittsburgh, 70c.; Mahoney and Shenango Valley, \$1.35; St. Louis, \$3.05; Chicago, \$2.75; Cleveland, \$1.70; Cincinnati, \$2.65; Louisville, \$3.20.

FREIGHTS.

From Baltimore to: Boston, Mass., 1.15; Charleston, 90@1.00; Fall River, 1.10; Galveston, 3.00; New Bedford, 1.10; New Haven, 1.10; New London, 1.10; New York, N. Y., 1.05; Norfolk, Va., .65; Portland, 1.15; Providence, 1.10; Richmond, Va., .70; Rockport, Mass., 1.30; Salem, Mass., 1.25; Savannah, 1.15; Somerset, 1.10.

* And discharging. † Alongside. ‡ And towage.

METAL MARKET.

NEW YORK, Friday Evening, March 14.
Prices of silver per ounce Troy.

Mar	Sterling Exch'go	London Pence.	N. Y. Cts.	Mar	Sterling Exch'go	London Pence.	N. Y. Cts.
8	4.85	44	95½	12	4.84	43¾	95½
10	4.84½	44	95½	13	4.83¾	43¾	95½
11	4.84	43¾	95½	14	4.84	43¾	95½

*94½ to 95. †95 to 95¼

Council bills declined ½d. per rupee on this week's allotment. Both silver and exchange have been weak and declining, but silver closes stronger with an upward tendency.

The Spanish government has bought 30,000 kilograms of silver to mint into coins. There is no lack of silver currency, but the government will make a large profit out of the transaction, which seems, indeed, to be the only reason for coining more silver.

Foreign Bank Statements.

The governors of the Bank of England at their weekly meeting on Thursday reduced its minimum rate for discount from 4½ to 4 per cent. During the week the bank gained £172,000 bullion, and

the proportion of its reserve to its liabilities was raised from 48.90 to 51 per cent. against a decline from 42.79 to 42.09 per cent. In the same week of last year, when its rate for discount was 3 per cent. The bank, on the 13th inst., gained £44,000 bullion on balance. The weekly statement of the Bank of France shows a loss of 425,000 francs gold and an increase of 200,000 francs silver.

Domestic and Foreign Coin.

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

	Bid.	Asked
Trade dollars.....	\$.76	\$.78
Mexican dollars.....	.74½	.76
Peruvian soles and Chilean pesos.....	Nom'al.	Nom'al.
English silver.....	4.83	4.88
Five francs.....	.94	.95
Victoria sovereigns.....	4.86	4.88
Twenty marks.....	3.86	3.90
Spanish doubloons.....	4.74	4.78
Spanish 25 pesetas.....	15.55	15.70
Mexican doubloons.....	4.82	4.88
Mexican 20 pesos.....	15.55	15.70
Ten guilders.....	19.50	19.60
	3.96	4.00

Copper.—The general tone of the copper market is very steady, and the business doing is quite satisfactory. The demand on the part of consumers is very good indeed, and although we have no alteration to report in prices, there is certainly no disposition on the part of producers to reduce quotations. In comparison with other descriptions the price of lake copper is high enough, and leaves a very handsome margin of profit to the producing companies. The quotations now ruling are: Lake copper 14½@15, Arizona refined copper 13¼@14, casting copper 12¾@13.

In London the speculative market for Chili Bars and G. M. Bs. has fluctuated somewhat during the week, and while the closing quotations last week were £46 10s. @ £46 12s. 6d. spot, and £47 @ £47 2s. 6d. three months, yesterday (Thursday), £47 15s. @ £47 17s. 6d. spot, and £48 @ £48 5s. was the highest level touched, and the lowest cable quotations to-day show a slight reaction at £48 7s. 6d. @ £47 10s. spot, and £47 17s. 6d. @ £48 3s. three months. The slightly easier tendency in the European markets has now made some impression on the London quotations for refined and manufactured sorts. The latest quotations for such being: English tough, £52 @ £53; best selected, £54 @ £55; strong sheets, £61 @ £62; India sheets, £53 @ £59, and yellow metal, 6d.

During February there were shipped from Houghton, Mich., by the Duluth, South Shore & Atlantic Railroad, 208 cars of refined copper, plates, bars and ingots, weighing 5,214,132 pounds, which at the present market price of copper is worth \$756,049.14. These shipments do not include the manufactured products of the Tamarack-Osceola Copper Manufacturing Company at Dollar Bay, Mich., wire, rod and sheet copper.

William A. Clark, of Butte, Mont., has begun suit in this city against the *société Industrielle Commercial des Metaux* to recover \$250,000 damages on account of a breach of a contract made in 1889 to buy from him the entire production of his mines in Montana during 1889 and 1890 at 12 cents a pound. An attachment against the property of the French organization in this city was granted on the 7th inst.

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

To Liverpool.	Copper matte.	Lbs.
By S. S. City of Chester.....	215 bbls	244,068
By S. S. Italy.....	2,164 sacks	240,303
To Hamburg.		
By S. S. Rugla.....	698 bags	71,001
		7,000

Tin.—The market has been dull throughout the week, and quotations have slowly declined. The arrivals have been rather heavy lately, and several steamers with further supplies are now due, so that the premium lately commanded for spot tin and early deliveries has tended to disappear. The market was rather higher to-day for spot and near delivery, and considerable business took place.

We quote to-day spot, 20½; March, 20¾; April, 20¾; May, 20¾; June, 20¾. In London the market has shown very little animation, and quotations have only marked slight variations from day to day, the closing quotations to-day being £90 10s. @ £90 12s. 6d. spot and £91 10s. @ £91 12s. 6d. three months.

Lead.—Some small consumers have been obliged to come into the market, but the more important buyers are still holding off. The business done has consequently been of quite a retail character, and several small lots have changed hands at 4c., and subsequently at 3-97½c., at which latter figure the market closes. No progress is reported regarding the constitution of the new Smelting Trust, but the Western smelters are still keeping out of the market with their metal.

The London market has been quiet, and the latest quotations there are Spanish, £12 10s.; English, £12 15s.

The Chicago Market.—Messrs. Everett & Post, of Chicago, telegraph us as follows: The market has been very quiet during the past week, consumers being supplied with the March delivery. Sales of 200 tons at \$3.80 @ \$3.85. At the close \$3.85 is asked.

The St. Louis Market.—Messrs. John Wahl & Co. telegraph us as follows: The advance in pig lead for the time being appears to be checked. When the

metal touched 3-80, buyers found a liberal supply. Transactions since our last report will probably aggregate 700 tons at prices ranging from 3-75 @ 3-80c. At the close the undercurrent is slightly easier, with sellers of common at 3-77½.

Spelter is very irregular, and sales at low prices are reported. We must therefore reduce the quotation for prime Western to 5-15 @ 5-20.

The London quotations are specials £22 5s., ordinaries £22.

Antimony.—Prices are fairly sustained and a regular jobbing business is being done. The quotations are Hallett's 19½@20c., Cookson's 23½@24c.

Nickel.—There is nothing new in this metal; it rarely experiences fluctuations. Quotations are 75 @ 80c.

Quicksilver.—The same general features prevail in quicksilver. Prices are a little off, \$49.50 @ \$50 in New York and £9.5s in London.

IRON MARKET REVIEW.

NEW YORK, Friday Evening, March 14.

Pig Iron.—The dullness and weakness in the pig-iron market, which we have noted from week to week for some time past, has culminated, as was foreshadowed, in a break in prices. During the past week the quotations for Southern irons were reduced about a dollar and a half a ton at Birmingham, Ala., and a corresponding reduction has taken place in the markets supplied from that center. This, however, does not mean that a general break of a dollar and a half has occurred in the pig-iron market of the country, for Birmingham makers were holding above the average of the furnaces in other districts, and the actual quotations in the New York market have varied but little from what we have been reporting for a few weeks past. Production has increased during the past month, and the prospect is that the current month will show a still further increase in output. All this strengthens consumers, and has somewhat discouraged producers, and no doubt has helped to bring about the action of the Southern iron masters.

The cost of making iron is considerably higher than it was a year ago, ore prices being very high, and contracts made for a good way ahead, while coke is now nearly double what it was then. It is, therefore, impossible for iron to fall to the old figures, but that it will be maintained at the present rates during the next two or three months seems improbable. We do not, however, anticipate any demoralization in the trade, and it is probable that consumers will now commence to buy more freely, and will thereby sustain the market. We may quote No. 1 now as \$18.50 @ \$19; No. 2, \$17.50 @ \$18, and forge \$17 @ \$18. Some of our Northern furnaces still hold at the old prices, but it is nevertheless possible to get good iron at about these rates.

The Cameron Coal and Iron Company, which is now in the hands of a receiver, we are told offers in Western New York and Pittsburgh 2,500 tons of No. 2 foundry for \$18, and it is intimated that less than this figure would buy the lot.

Scotch pig.—The Scotch market is again off a little and warrants are quoted at about 50s. a ton. A little iron has been received during the week in this market, but as already stated there is no demand here at importation prices.

Spiegeleisen and Ferro-Manganese.—Nothing new to report in this article; prices remain at \$34 to \$35 for 20 per cent., and 80 per cent. ferro is worth from \$90 to \$95, according to date of delivery and importance of the order. For distant deliveries a lower price is named, \$85 being a fair quotation.

Steel Rails.—We hear of some contracts having been placed during the week at current prices. We may quote from \$34.50 to \$35, the latter figure being the asking price at all Eastern mills.

Structural Iron and Steel.—The building trade still continues unusually active for this season of the year, the warm weather having kept builders at work far beyond the time when they are usually stopped. The spring trade is also opening, and inquiries are becoming more abundant both for iron and steel. Many new buildings are projected in this and other Eastern cities where the frame of the building is altogether of iron and steel, the walls being merely filled in with brick, the strength of the structure depending upon its metal components. We anticipate a large business in structural steel during the current year, and every indication at present confirms this.

The Sparrow Point Works, near Baltimore, are being prepared for ship building and will commence at once with the construction of several large ore-carrying vessels to carry the company's own ores from their mines in Cuba to Sparrow Point. A large number of steel vessels are also being laid out or are being built for the lake trade, and this is also consuming a large amount of metal. We continue our quotations of last week, which are as follows: Bridge plate, delivered on wharf, 2-30c.; iron angles, 2-30c.; iron tees, 2-80 @ 2-85c.; steel angles, 2-70c.; beams and channels on wharf, 3-1c. Steel plates on wharf: Tank and ship, 2-75c.; shell, 3c.; flange, 3-25c.; fire-box, 4 @ 4-1c. Iron plates on wharf: Common tank, 2-35c.; refined, 2-45c.; shell, 2-6c.; flange, 3-5 @ 3-7c.; extra flange, 3 @ 4c. Bar iron at mill is quoted at 1-9c. for common, and 1-9 @ 2c.

for refined. Deliveries from store are quoted as follows: Common, 2 1/2c. base; refined, 2 3/4c. base; "Ulster," 3c. base; Norway bars, 4c.; shapes, 5c., and Norway nail rods, 5 1/2c.

Merchant Steel.—This article remains unaltered both in demand and price. We continue to quote: Best English tool steel, 15c. net; American tool steel, 7 1/2@10c.; special grades, 13@20c.; crucible machinery steel, 5c.; crucible spring, 3 1/2c.; open-hearth machinery, 2 3/4c.; open-hearth spring, 2 1/2c.; tire steel, 2 1/2c.

Rail Fastenings.—We can only continue to quote nominally as in our last issue: Spikes, 2 1/2c.; angle fish-plates, 2 1/2@2 5/8c.; bolts and square nuts, 3c.; hex nut, 3 1/4c.

Tubes and Pipes.—These articles have not varied in price. The demand is still quite large, though not more active than for some time past. The prospect of a large business during the current year seems to improve as the season advances. The monthly meeting of the association has not been held yet. We continue to quote as follows: The ruling discounts on car lots are 47 1/2 per cent. on small black, 40 on galvanized, 60 on large orders of black and 47 1/2 on large lots of galvanized; 45 on 1 3/4-inch boilers, 50 for 2- to 4-inch and 52 1/2 on larger than 4-inch.

Old Material.—Old rails are quoted at \$25@ \$26. We hear of sales at \$25.75, and any large buyer could get something off of this price. From the West we learn that the price of old rails in Pittsburg has dropped off somewhat.

Chicago. March 12.
(From our Special Correspondent.)

Pig Iron.—Prices have been fairly well maintained during the past week, the market moderately active but unchanged. We quote to-day for cash per ton of 2,240 pounds: Lake Superior charcoal No. 1 and 2, Lake Superior for car wheels, No. 3, and Lake Superior for malleable, No. 4 and 5, \$23@ \$23.50.

No. 1 Scotch, according to brand, \$26@ \$27; No. 1 American Scotch, Ohio black brand, \$22@ \$22.50; No. 1 American Scotch, (Milwaukee) \$19.50; No. 1 silvery, \$20@ \$21; cold blast charcoal for car wheels, \$26@ \$30; old car wheels, \$20.50; old rails, \$23.50@ \$24; bar iron, common, \$1.85 per 100 lbs.; rail splices, bars, \$1.90 per 100 lbs.

Cleveland. March 13.
(From our Special Correspondent.)

There is nothing new to report relative to the iron ore market, except that a little inquiry has sprung up from the East for ore for immediate delivery.

The Thomas Iron Company has offered for fifty to one hundred thousand tons of soft "Non-Bessemer" hematite five cents a unit, delivered at Escanaba. No business, however, can be done at such a figure. This price would make 60 per cent. ore worth \$3 at Escanaba, or \$4.10 at Cleveland, whereas all such ores have sold so readily this year at \$1.50 at Cleveland, for this coming season's delivery, that there is no more to be had at that price. A large amount of the same grades of ore has even been sold to Eastern parties at prices which net the ore man the same as above stated, viz., not less than \$4.50 at Cleveland, or from \$3.40 to \$3.50 at Escanaba.

Lake freights continue unchanged, viz., \$1.35 to \$1.40 from the head of Lake Superior, \$1.25 from Marquette, and \$1.10 from Escanaba, for contracts running into October.

Papers this morning report a strike of all the miners at the Norrie mine. We cannot tell how long this may last, but it accords with the opinion expressed in my last letter, viz.: That strikes and such delays are always liable to obstruct the production of ore, and any strike of this kind which would last long would seriously curtail the product of an iron mine. As this mine expects to ship seven to eight hundred thousand tons of ore next year, it can be readily seen that every day's cessation of work curtails the estimated product 2,500 tons. Quotations remain the same, and are as follows:

SPECIAL AND MAGNETIC ORES.	
Bessemer	66@69 per cent. \$6.75@ \$7.50.
"	60@64 " 5.25@ 6.50.
Non-Bessemer	66@69 " 6.00.
"	62@65 " 5.25@ 5.75.
"	57@60 " 4.25@ 5.00.
SOFT HEMATITES, DRIED AT 212.	
Bessemer	52@55 per cent. \$5.25@ \$6.00.
"	50@61 " 5.00@ 5.25.
Non-Bessemer	57@2 " 4.25@ 5.00.

Above prices are delivered on docks at Lake Erie ports.

Louisville. March 11.
(Special report by Messrs. HALL BROS. & Co.)

The week passed has witnessed a very dull and quiet market. No sales of any moment have been reported, but the tendency has been in favor of the purchasers. It is thought that a more liberal buying spirit will be developed soon.

There is no material change in quotations.

Hot Blast Foundry Irons.

Southern Coke No. 1	\$18.25@ \$18.75.
" No. 2	18.00@ 18.50.
" No. 3	17.50@ 17.75.
Mahoning Valley, Lake ore mixture	19.50@ 20.00.
Southern Charcoal No. 1	18.50@ 19.00.
" No. 2	18.00@ 18.50.
Missouri " No. 1	19.00@ 19.50.
" " No. 2	18.75@ 19.00.

Forge Irons.

Neutral Coke	17.00@ 17.50.
Cold Short	16.75@ 17.00.
Mottled	15.50@ 16.00.

Car Wheel and Malleable Irons.

Southern (standard brands)	23.50@ 24.00.
(other brands)	15.50@ 20.50.
Lake Superior	23.00@ 23.50.

Philadelphia. March 23.
(From our Special Correspondent.)

Pig Iron.—Matters connected with the iron trade are in a somewhat mixed-up condition on account of the vacillating course pursued by would-be large buyers and large makers. There are elements of both strength and weakness in the market. In fact, the entire market is of a most contradictory character. Gray forge has been selling this week at \$17@ \$17.25; in a few instances sales have been made as low as \$16.75. There are rumors of Southern iron coming into this market, but the only facts to be ascertained are that offers have been made, both on the part of buyers here, and by makers there, but no business closed. No. 2 foundry iron is quoted at \$18@ \$18.50; No. 1, at \$19.50@ \$20.50. In some instances No. 1 has been shaded a little below \$19.50, but the iron was not very good. Pig iron makers see difficulties ahead of them on account of the cost of raw material. Finished products are not high enough to warrant buyers in paying present high prices. It would be a difficult matter to make large sales of Bessemer pig, and it is doubtful whether more than \$20 dollars could be had at furnace.

Foreign Material.—Both spiegeleisen and ferro-manganese have been selling in a small way. Quotations, \$35 for 20 per cent. spiegel and \$85 to \$100 for ferro-manganese, according to conditions.

Billets and Slabs.—Billets have been unsettled, and the downward tendency is quite marked. There are inquiries on the market for large lots, but buyers insist upon extremely low prices. Most consumers are in a position to wait, and will pursue their present policy, so long as prices remain unsettled. But consumption is heavy, and makers think buyers will eventually have to come in and pay fair prices. Quotations are \$34 to \$35 nominally.

Blooms.—Scrap blooms sold to-day at \$35; anthracite are quoted at \$45, and charcoal, \$52.50@ \$55.

Muck Bars.—Buyers are holding off, believing the market likely to weaken. Outsiders claim that prices will soon settle down to \$30 at mill.

Merchant Iron.—The anxiety of small mill men to secure business has led to some secret cutting of prices, and quotations for refined may now be given at 1 1/2, although there are two or three makers who would not accept that price.

Skelp Iron.—Quotations are 1 1/2 for grooved and 2 1/2 for sheared. There are a good many buyers ready to place orders as soon as they are sure that prices have touched bottom.

Sheet Iron.—All mills throughout the State are in excellent condition as regard business, and manufacturers are not making any efforts to increase their orders. Card rates are strong at 3 1/2 to 3 7/8 for refined.

Wrought Iron Pipes.—All the mills continue busy; manufacturers report a fair inquiry for early and midsummer business.

Nails.—The nail makers are in session at the present writing, and will not adjourn, so one of the officers stated, until some plan for restricting production and maintaining fair margins has been settled upon. The difficulty is, that poor nails are being constantly sold at cut rates, and while standard makers want more, they find it very difficult to hold prices. Quotations for car lots, \$2 to \$2.10.

Plate and Tank.—Plate iron has been shaded this week down to 2 1/2 for two or three good-sized orders just placed. The downward tendency is likely to affect shell and flange also. Steel plate is under active inquiry, and the downward tendency is shown in it.

Structural Iron.—Structural iron is quiet, although not because of any lack of business to be placed. Buyers believe that shapes will weaken, and so are not buying more than they are obliged to have for immediate use. Quotations for bridge plate are 2 1/2, with offers at less; angles, 2 1/2; tees, 2 1/2; beams, 3 1/2. Some interesting news in this direction is daily expected.

Steel Rails.—Several small lots of rails have been taken since Monday, and it is claimed that two mills have booked orders this week for 15,000 tons; if \$35 has been shaded, the fact is kept secret. There is more or less uncertainty in the market, owing to the tariff agitation; but that can have but little influence, one way or the other.

Old Rails.—Old rails are quoted at \$26 on the seaboard; very few lots are selling.

Scrap.—No. 1 scrap is quoted at \$24; some yard men are holding at \$24.50. Turning, \$17; old car wheels, \$18.50. Very little is doing in any kind of scrap this week.

Pittsburg. March 13.
(From our Special Correspondent.)

Rail Iron.—We have to report a very quiet market, consumers still holding off, as a general thing offering prices that holders refuse to accept. The natural result is, sales do not show up to any

great extent, as consumers are purchasing limited amount for use as mixtures, until they can make a satisfactory arrangement with sellers. Just how long this condition of affairs will hold out no person can find out; as usual, on a declining market, rumors are set afloat about iron being sold way down below asking rates, but diligent inquiries fail to discover either the buyer or the seller. For standard brands or city furnace made iron prices are fairly maintained, and future prices will be governed by the party that can hold out the longest. There seems to be no falling off in consumption, and stocks in the hands of consumers are steadily diminishing, and must be replenished in the near future.

Some furnaces are running at a loss, and others are making narrower margins of profit than last fall. This fact is due to the advance in cost of materials and the increasing output, which has created a little sharper competition than usual and has been followed by a temporary depression in prices. Large buyers are at the present time holding aloof from the markets and small buyers are purchasing in a hand-to-mouth way. On the other hand, there is an enormous consumption in progress, and as stocks are light in both makers' and buyers' hands, and spring and summer prospective requirements large, the feeling is widely entertained in the trade that within a few weeks prices will regain their former strength and demand its former activity.

On this account, certain large companies are refusing to follow the market in its downward tendency. The outcry about declining prices has very little, really, to depend upon; makers insist that the enormous consumption of iron will take care of prices, while buyers claim that the rapid increase in production will keep prices at the lowest possible point.

It should be borne in mind in endeavoring to come to a conclusion in regard to the future course of prices in the iron trade, that contracts for Lake Superior and other ores have been placed for the season; that the price of labor is virtually fixed; that freight rates have advanced; that coke has advanced, and may go higher. It is therefore difficult to see how iron can decline lower than present quotations.

Coal and Coke Smelted Lake Ore.

2,000 Tons No. 1 Bessemer City Furnace	21.50 cash.
2,000 Tons Bessemer	20.50 cash.
2,000 Tons Bessemer	20.50 cash.
1,000 Tons Bessemer	21.50 cash.
700 Tons Gray Forge	18.75 cash.
500 Tons Gray Forge	17.00 cash.
500 Tons off Bessemer	18.00 cash.
300 Tons Gray Forge	17.25 cash.
200 Tons Gray Forge	17.80 cash.
163 Tons No. 1 Foundry	18.50 cash.

Coke, Native Ore.

700 Tons off Bessemer	19.75 cash.
100 Tons No. 2 Foundry	18.50 cash.
100 Tons Silvery Extra	21.00 cash.
50 Tons Silvery	18.50 cash.
75 Tons No. 2 Foundry, all ore	19.00 cash.

Charcoal.

80 Tons Cold Blast	26.50 cash.
60 Tons No. 2 Foundry	22.75 cash.
50 Tons Cold Blast	29.25 cash.
50 Tons White	21.50 cash.

Muck Bar.

500 Tons Neutral	29.00 cash.
500 Tons Neutral	23.75 cash.
400 Tons Neutral	29.25 cash.

Steel Slabs and Billets.

750 Tons Nail Slabs	31.50 cash.
500 Tons Billets	33.00 cash.
1,800 Tons Billets	34.00 cash.

Steel Wire Rods.

700 Tons American Fives	48.00 cash.
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Bloom Ends.

500 Tons Bloom Ends	24.50 cash.
300 Tons Bloom Ends	25.00 cash.
275 Tons Bloom Ends	24.75 cash.

New Steel Rails.

2,200 Tons, April delivery	34.50 cash.
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Ferro-Manganese.

150 Tons 80 per cent., seaboard	85.00 cash.
50 Tons 80 per cent., seaboard	90.00 cash.

Spiegel.

100 Tons 10 and 12 per cent.	32.50 cash.
50 Tons 20 per cent.	35.00 cash.

Skelp Iron.

300 Tons Wide Ground	18 1/4 mo.
250 Tons Narrow Ground	18 1/4 mo.
150 Tons Sheared Iron	20 mo.

Old Iron and Steel Rails.

1,000 Tons American Ts	26.25 cash.
700 Tons American Ts	26.25 cash.
700 Tons American Ts	26.00 cash.
300 Tons Old Steel Rails	22.50 cash.

Lake Superior Ore.

2,000 Tons Non-Bessemer Lake ports	5.00 cash. EVANS.
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Prices.

Coke or Bituminous Pig—	20% Spiegel at
Foundry No. 1	Pittsburg @ \$35.00@ \$36.30
Foundry No. 2	Muck Bar... 28.75@ \$30.00
Gray F. No. 3	Steel Blooms... 33.00@ \$34.00
No. 4	Steel Slabs... 31.50@ \$32.50
White	Steel Crp Ends 25.00@
Mottled	Steel Bl. Ends... 24.5 @ \$24.75
Silvery	Ferro-Man., 80% seaboard, 90.00@
Bessemer	Old Billets... 33.00@ \$34.00
Low Phos.	Old Iron Rails... 26.50@ \$27.00
	Old Steel Rails... 22.50@ \$23.00
	No. 1 W. Scrap... 22.50@ \$23.00
	No. 2 W. Scrap... @ \$18.00
	Steel Rails... 35.50@ \$34.00
	Light sec... 35.00@ \$33.00
	Bar Iron, nom... 1.90@ 1.85
	Iron Nails... 2.25@
	Steel Nails... 2.25@
	Wire Nails... @ \$2.80

CHEMICALS AND MINERALS.

New York, Friday Evening, March 14.

Heavy Chemicals.—Quite a change has taken place in this market. "Not for ten years has there been such a state of affairs," said a prominent dealer. "There is very little in stock in New York, and in ten days or two weeks, when steamers come in empty which should bring a large lot of chemicals, the pinch will be felt."

In regard to the proposed English alkali syndicate, we are informed that a meeting of persons interested in the scheme took place recently, but the general impression is that nothing will be effected.

Caustic soda for shipment is quoted, for the 60 per cent. variety, \$3.05@3.10; for 70 per cent., \$2.85@2.90, and for 74 and 76 per cent., \$1.75@1.80.

Sal soda is \$1.10@1.12 1/2. Caustic soda ash on the spot is at 1 1/2 c. in round lots.

A syndicate came into the market in the early part of the week and took out about 500 tons of bleaching powder, practically cleaning out the market. Prices are steady at \$1.70 to \$1.80.

Acids.—There is a somewhat better demand for acids this week, and manufacturers generally express themselves as satisfied with the turn affairs have taken. For some time past there has been a great deal of complaint at the dullness of the market, although nothing else could have been reasonably expected at this time of the year, but now producers are assuming a more hopeful view of things.

Oxalic shows no change over last week. For large contracts now being filled 6c. is the price, and on small lots quotations are 6 1/2 @ 6 3/4 c.

Nitric.—There is nothing new to report in this article. We hear less of the cutting of prices by the "combine," and there is no change in demands.

Sulphuric acid is quiet, the demand steady and large, but not unusually so. There is no change to note in prices. There is a report that English capitalists are about purchasing a large well-known pyrites property in Virginia, and will put up large acid and fertilizer works at the mine.

Fertilizing Chemicals.—The fertilizing market is practically unchanged, prices if anything showing an upward tendency with the approach of spring. The only thing that can check this is for the market to be flooded with raw material, and this is scarcely possible.

The Northern trade is generally reported as being more active, and one firm informs us that they have received inquiries concerning their products from certain districts of the West, where a few years ago fertilizers were not even dreamed of.

We are in receipt of interesting statistics from Mr. Paul C. Trenholm, of Charleston, S. C., which we herewith publish.

The shipments of fertilizers from Charleston for September, October, November and December of 1888, and January and February of 1889, were 113,710, and for the corresponding months of 1889 and 1890 they were 174,956 tons, an increase in the latter of 81,246, or 54 per cent. excess over 1888-1889.

Shipments during February aggregated 9,184 tons of crude rock and 449 tons of ground rock, the latter all going to Elizabethport, N. J. Of the crude rock New York received nothing; Baltimore received 2,240, the largest amount shipped to any one point.

The shipments for the corresponding month in 1889 were 13,828 tons of crude and 670 tons of ground rock.

Dried blood still continues firm at \$1.95@2 for high grade, and \$1.85 for low grade. Other ruling prices are as follows: Azofine, \$1.95@2; dried blood, low grade, \$1.85@1.90; high grade, \$2. Tankage, high grade, 9 to 10 per cent. ammonia and 15 to 20 per cent. phosphate, \$20@21 per ton, and low grade, 7 to 8 per cent. ammonia and 25 to 30 per cent. phosphate, \$18.50.

Charleston rock, undried, \$5.75 per ton; kiln-dried, \$6.75@7 per ton, both f. o. b. vessels at the mines. Freight by rail from Charleston to New York, \$3@3.25 per ton. Charleston rock, ground \$11.50@12, ex-vessel at New York.

Double manure salts 48 to 51 per cent. sulphate of potash, \$1.12 1/2 per 100 pounds for shipments after April 1st; high grade manure salts, basis 90 per cent. sulphate of potash, \$2 37 1/2 per 100 pounds. For lots on the spot, an advance over the above-named figures of 2 1/2 c. per 100 pounds is quoted.

Muriate of Potash.—There is a fair jobbing demand, and about 100 tons have been sold in this way. Prices are \$1.80@1.85, although it may be doubted if \$1.80 could be obtained for lots of over 50 tons.

Brimstone.—We have nothing new to record. Quotations are now \$19.75 for best unmixed seconds, and \$18.50@19 for best thirds.

Nitrate of Soda.—Contrary to expectations, nitrate of soda is doing better; \$1.77 1/2 on the spot and to arrive, future shipments are \$1.75. The recent auction of the cargo of the "Wachussetts" had a demoralizing effect. Had it not been for that sale, spot prices would have probably been higher.

Kainit.—The nominal price of this article is about \$11, although there is practically none for sale. In fact, the only way in which it could be obtained would be for buyers to dispose of some of their own stock at handsome figures. A few weeks should see some change, inasmuch as the spring season will then open on the other side.

Liverpool. March 5.

(Special Report by J. P. Brunner & Co.)

The labor difficulty referred to in our last continues to interfere with trade, and there is little active business passing this week, manufacturers being afraid to quote, except for immediate delivery, while buyers are also afraid to operate,

fearing that, in the case of strikes, they will not be able to get delivery of their purchases.

Soda ash continues in a strong position, and high test carbonated is unobtainable for this or next month, while 1 1/2 @ 1 3/4 d. are nearest values for forward delivery. Forty-eight per cent. carbonated ash is little inquired for, but with limited supplies prices are firm at 1 1/2 @ 1 3/4 d., according to brands. Caustic ash quiet, but scarce, and 1 1/2 @ 1 1/4 d. asked, according to brands.

Soda crystals in request, and held for £2@£3 2s. 6d. per ton.

Caustic Soda.—In consequence of the labor troubles, prices of this article have been advanced, and there is little offering. Sixty per cent. is scarce at £8 7s. 6d.@£8 10s., while some makers decline to shade £9. Seventy per cent. some second hand parcels have been sold at £9 7s. 6d. to £9 10s., while in some cases makers hold for £10. Seventy-four per cent., scarce at £10 5s.@£10 10s. Seventy-six per cent., £11.

Bleaching powder is about unchanged, and £5 12s. 6d.@£5 15s. represent nearest spot values, while there is little offering for prompt delivery.

Chlorate of potash scarce, and price advanced to 5d. for prompt delivery, and 5 1/2 d.@5 3/4 d. asked for forward contracts.

Bicarb. soda continues in good request at £5 15s. per ton and upward, for one cwt. kegs, according to brand and quantity, with usual allowances for larger packages.

Sulphate of ammonia still tending downward, and £11 12s. 6d.@£11 15s. are nearest quotations to-day, for good grey 24 per cent. f. o. b. Liverpool.

BUILDING MATERIAL MARKET.

New York, Friday Evening, March 14.

Brick.—The market for this branch of building material continues quiet, with a large supply and a moderate demand. Quotations are: For best Haverstraw, \$7.25@7.50 per M.; Uprivers, \$6.75@7.25; Jerseys, \$5.50@7.25, and pales, \$3.50@3.75.

Lime.—There is more lime coming in, although there is not enough here yet to supply the demand. The open winter has enabled building to be carried on, and the demand for lime was unexpected. The kilns were late in starting, and the vessels encountered bad weather during the past two months. One ship which left Portland on the 12th ult. did not arrive here till the 8th inst. There are now about 40,000 casks of lime shipped weekly from Portland, and the scarcity of the metal will probably be at an end in a short time. The prices, being those fixed by the Maine Association, remain unchanged as follows:

Rockland common, \$1 per bbl.; Rockland finishing, \$1.20; St. John common and finishing, 90@95c.; Glens Falls common and finishing, 85c.@\$1.11.

NOTES OF THE WEEK.

The firm that has the contract for the free stone carving on the City Hall in Cambridge Mass., has agreed to conform to the rules of the Free Stone Cutters' Union, and the men have been instructed by the union to return to their work. The free stone cutters of Boston state that this action is the beginning of a break among the contractors. The locked out cutters assert that they are as firm as at the beginning of the trouble. A number of cutters left Boston on the 11th inst. for other cities, and promises of financial aid are received from New York, Chicago, Philadelphia and other cities.

Plans for 71 new buildings, to cost \$1,315,000, were filed at the Building Bureau for the week ending Thursday.

IMPORTS AND EXPORTS OF METALS AT NEW YORK MARCH 1 TO MARCH 8 AND FROM JANUARY 1.

Table with columns for Imports (Spelter, Pig Lead, Tin) and Exports (Tin Plates, Bruce & Cook, Byrne & Son). Rows list various companies and their respective quantities and values.

Table with columns for Steel Blooms, Billets, and Slabs; Bar Iron; Scrap Iron. Rows list various companies and their respective quantities.

Table with columns for Steel and Iron Rods, Copper, Copper Matte. Rows list various companies and their respective quantities and values.

DIVIDEND-PAYING MINES

NON-DIVIDEND PAYING MINES

Main table with columns for Name and Location of Company, Capital Stock, Shares, Assessments, Dividends, and Name and Location of Company, Capital Stock, Shares, Assessments. Lists various mining companies and their financial details.

G. Gold. S. Silver. L. Lead. C. Copper. * Non-assessable. † This company, as the Western, up to Dec. 10th, 1881, paid \$1,400,000. ‡ Non-assessable for three years. § The Deadwood recently paid \$275,000 in eleven dividends, and the Terra \$75,000. ¶ Previous to the consolidation in Aug. 1884, the California had paid \$31,321,000 in dividends, and the Ccn. Virginia, \$40,000. ** Previous to the consolidation of the Copper Queen with the Atlanta, Aug., 1885, the Copper Queen had paid \$1,250,000 in dividends. †† 1,600,000

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 8 to March 14, along with sales figures.

*Ex. dividend. †Dealt in at the New York Stock Ex. Unlisted securities ‡Assessment unpaid. Dividend shares sold, 32,633. Non-dividend shares sold, 81,000. Total, New York, 91,633.

BOSTON MINING STOCK QUOTATIONS.

Table with columns for 'BOSTON MINING STOCK QUOTATIONS'. Lists company names and their stock prices for various dates from March 7 to March 13, along with sales figures.

Boston: Dividend shares sold, 19,647. Non-dividend shares sold, 18,358. Total Boston, 38,005.

COAL STOCKS.

Table with columns for 'COAL STOCKS'. Lists company names and their stock prices for various dates from March 8 to March 14, along with sales figures.

**Sales in New York, 441,585; in Philadelphia, 78,366. Total sales 647,479.

San Francisco Mining Stock Quotations.

Table with columns for 'San Francisco Mining Stock Quotations'. Lists company names and their closing stock prices for various dates from March 7 to March 13.

STOCK MARKET QUOTATIONS.

Baltimore, Md. Table with columns: COMPANY, Bid, Asked, L. H., L. H. Includes items like Atlantic Coal, Big Vein Coal, Conrad Hill, etc.

Birmingham, Ala. Table with columns: COMPANY, Bid, Asked, L. H., L. H. Includes items like Ala. R. Mill Co., Alice Furnace, Anna Howe, etc.

Kansas City, Mo. Table with columns: COMPANY, Par value, Bid, Asked. Includes items like Ben Harrison, Furch, L. & Z., Express Group, etc.

Pittsburg, Pa. Table with columns: COMPANY, B., A. Closing. Includes items like Allegheny Gas Co., Bridgewater Gas Co., Chartiers Val. Gas, etc.

Sales at the New York Stock Exchange week ending March 11. Table with columns: Sales, Price. Includes American Cotton Oil, National Lead, Sugar, etc.

St. Louis, March 12. Table with columns: COMPANY, Bid, Asked. Includes Adams, Colo., American & Nettie, Anderson, etc.

Trust Stocks. March 14. The following closing quotations are reported to-day by C. I. Hudson & Co., members of New York Stock Exchange: CERTIFICATES. American Cotton Oil, old, \$7 @ \$35...

Foreign Quotations. London. Table with columns: COMPANY, Highest, Lowest. Includes Al'mada, Mex., Amador, Cal., Apurimac, N. C., etc.

Paris. Table with columns: Belmez, Spain, Franks, Franks. Includes Callao, Venez., Callo Bis, Venez., etc.

CURRENT PRICES. These quotations are for wholesale lots in New York.

CHEMICALS AND MINERALS. Table with columns: Acid-Acetic, Muriatic, Nitric, Oxalic, Sulphuric, etc. Includes various chemical products and their prices.

Salt-Liverpool, ground, sack, 75 @ 81. Table with columns: Salt-Liverpool, Turk's Island, Salt cake, etc.

THE RARER METALS. Table with columns: Aluminum, Arsenic, Barium, Bismuth, Cadmium, Calcium, Cerium, Chromium, Cobalt, etc.

BUILDING MATERIAL. Table with columns: Bricks-Pale, Bricks-Red, Bricks-Blue, etc. Includes various building materials and their prices.