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MESSRS. JOHN WAHL & CO., of St. Louis, have been appointed by the Kansas City Smelting and Refining Company sole agents for the sale of the company's pig-lead in the West. Hereafter, all orders should be addressed to them.

THE rapid succession of the meetings of the three great technical societies, and the fact that it has had a disturbing effect upon many engineers who are members of two or all of them, have brought out the suggestion that it might be a good plan to have one meeting of all of them, annually, held at the same time and in the same place. We believe that it is the practice of all the societies to hold their winter meetings, which are devoted more particularly to the reading and discussion of papers, in one of the large cities in the country. We can not see that there would be any serious objection to a joint meeting, the different societies being in session at the same time, like the different sections in such large bodies as the American Society for the Advancement of Science. Placing the average attendance at meetings at one hundred, a joint meeting would bring together about two hundred and fifty engineers, who could be easily accommodated in a large city. Every member of each society would be able then to hear and join in the discussion of

papers in which he has a special interest, and the social features, being common to all, would not suffer. Many busy men who now must choose between the rival attractions of two or three societies would make special efforts to find time to attend, and it need hardly be said that they are the very ones whose presence is most urgently desired, and who are the most important contributors to the general fund of knowledge and experience.

THE Pittsburg meeting of the American Society of Mechanical Engineers, of whose proceedings we print this week a final report, was a success, so far as the attendance, the interest in the proceedings, and the better acquaintance of the members with one another was concerned. The society is indebted largely for this result to the splendid hospitality of the Pittsburg members, who contrived to crowd into a few brief days feats of entertainment which only hearty good will and, let us add, some experience in the reception of technical societies could accomplish. Many of the most active members of the local committee have been frequent and prominent attendants of the Institute of Mining Engineers, and have brought to bear upon this, their best and most brilliant effort, the traditions and the methods of the older and more cosmopolitan sister society. The Society of Mechanical Engineers, with an increasing and influential membership, with the prospect of a better financial condition, and with active, efficient officers, who possess both enthusiasm and tact, has a brilliant future before it. The members show a keen appreciation of what is brought before them in the form of papers, and a striking disposition to add to the interest of the sessions by an active interchange of opinion; and yet it has struck us that on the whole this last meeting did not bring out any papers likely to make the transactions of the Pittsburg meeting a record to which engineers will turn with interest in coming years. Many if not all the authors were men of great ability, whose high standing in these specialties has been long acquired by important original work, and yet it must be confessed that some of the papers were disappointingly unimportant. They were not up to the standard that might be looked to, both as contributions to the literature of the subjects treated, or as works coming from men of acknowledged authority and ability. There is room for improvement in this direction, and we are convinced that the future will prove that we are not mistaken in our high estimate of the capacity of the Society to do good and fruitful work. It is not possible, nor do we expect that every meeting of the Society will be made memorable by the publication of papers that create a sensation here and abroad and deeply stir the technical world; but men of ability and experience owe it to themselves and to the Society that they bring contributions to technical literature which are thoroughly worked out.

THE CHICAGO MEETING OF THE AMERICAN INSTITUTE OF MINING ENGINEERS.

The opening session of the American Institute of Mining Engineers was held at the Grand Pacific Hotel.

The proceedings were opened by a few words of welcome by Mr. O. W. POTTER, on behalf of the local committee, and by Mr. CARTER HARRISON, Mayor of the city of Chicago, to which the President, Mr. JAMES C. BAYLES, briefly responded, and then delivered

THE PRESIDENT'S ADDRESS.

GENTLEMEN OF THE AMERICAN INSTITUTE OF MINING ENGINEERS; LADIES AND GENTLEMEN: The propriety of imitating in every thing, so far as I am able, the worthy example of the distinguished gentlemen who have dignified the honorable office of President of the American Institute of American Engineers imposes upon me the agreeable duty of delivering an address from the chair. The prominence which has been accorded in the programme of this meeting to the discussion of subjects connected with the study of metals, especially iron and steel, has naturally given direction to my thought.

It seems to be characteristic of invention and investigation that they conform to no law of regular and uniform development. From the measurably firm ground of accepted truth and verified experience, the work of original investigators is projected into the void of the unknown; and so rapid and important are the accretions of fact around such slender spars of well-directed speculation that it seems for a time as if we might go on extending and building them up until the void was fully and safely bridged. But such a line of investigation is like a cantilever with a pier at one end and nothing at the other. The limitations, not only of knowledge but of speculation, become evident as we load hypotheses upon the unsupported end of our structure; and to make our work of value, we must find a solid basis somewhere else, build thereon a pier, and project therefrom a second cantilever. When these meet and are securely united, we have spanned one of the spaces between facts learned by observation and experience, and can safely pass over to a point from which new speculations and verifications may serve as a basis for further progress.

We are impressed with the appropriateness of this figure when we examine the steps by which we have gained what little knowledge we

already possess of the composition and properties of iron and steel. That we know as much as we do concerning them, is surprising when we reflect that among our membership are many whose lives almost include the period in which these materials have been intelligently and systematically studied.

The progress of chemical science applicable to iron and steel analysis naturally invites attention first. Before quantitative analysis was attempted, certain of the crude reactions of qualitative analysis were recognized. Paracelsus, the marvelous charlatan who lived from 1493 to 1541, knew of some of these; and Boyle, an earnest worker in this field, records several in his *Essay on the Usefulness of Experimental Philosophy*, published in 1671. Marggraf, who lived from 1709 to 1783, is the first chemist who is credited with analyses of minerals. Thomson, in his *History of Chemistry* (London, 1831), says of Marggraf's work: "His attempts were rude, but their importance was soon perceived by other chemists, particularly by Bergman (1735 to 1784) and Scheele (1742 to 1786), whose industry and address brought the art to considerable perfection." Bergman, whose *De Analyti Ferri* was published in 1770, has left a very interesting record of his experimental work, which contributed in a material degree to advance the knowledge of the difference between iron and steel. He employed his pupils to collect specimens of iron from the different Swedish forges, and all of these specimens, to the number of eighty-nine, he subjected to a chemical examination by dissolving them in dilute sulphuric acid. He measured the volume of hydrogen gas which he obtained by dissolving a grain weight of each, and noted also the quantity and nature of the undissolved residue. The general result of the whole investigation was, that pure malleable iron yielded most hydrogen gas, steel less, and cast-iron least of all. The amount of Bergman's knowledge and the value of his methods may be judged from a table of percentages which he has left us, giving the composition of cast-iron, steel, and wrought-iron. This table shows the following results:

	Cast-iron.	Steel.	Wrought-iron.
Inflammable air.....	40.00	48.00	50.000
Plumbago.....	2.20	0.50	0.120
Manganese.....	15.25	15.25	15.250
Siliceous earth.....	2.25	0.60	0.175
Iron.....	80.30	83.65	84.450

In manganese determinations, Bergman evidently took care to avoid the discrepancies that are said to characterize the work of modern chemists, for we find that his manganese percentage is in each case 15.25 per cent. This celebrated chemist confirmed, to his own satisfaction, the conclusions of Réaumur (1683 to 1757), who considered steel an intermediate grade of metal between crude and malleable iron. His experiments showed that malleable iron left the smallest quantity of insoluble residue, steel a greater quantity, and cast-iron the greatest of all, and from this he drew his conclusions with respect to the difference between iron, steel, and cast-iron. "Nothing more was necessary," says Thomson, "than to apply the anti-phlogistic theory to these experiments, as was done some time after by the French chemists, in order to draw important conclusions respecting the nature of these bodies. Iron is a simple body, steel is a compound of iron and carbon, and cast-iron of iron and a still greater proportion of carbon. The defective part of the experiments of Bergman, as recorded in this important paper, is his method of determining the manganese in iron. In some specimens, he makes manganese amount to considerably more than one third part of the whole. Now we know," continues Thomson, "that a mixture of two parts of iron and one of manganese is brittle and useless. We are therefore sure that no malleable iron whatever can contain any such proportion of manganese. The fact is, that Bergman's method of separating iron ores was defective. What he considered manganese was chiefly, and might be in many cases altogether, oxide of iron. Many years elapsed before a good process for separating iron from manganese was discovered." To this I may add that many more years elapsed before steel containing 30 per cent of manganese, of which some description will be given in one of the papers to be read at this meeting, became a commercial product.

Among other investigations by Bergman was a series of experiments made by him with the view of ascertaining the cause of brittleness in cold-short iron. He extracted from such iron a white powder, by dissolving it in sulphuric acid. The white powder he succeeded in reducing to a white and brittle metal, by fusing it with a flux and charcoal. Klaproth (1748 to 1817) soon after described this metal as a phosphuret of iron, and Scheele, with his usual sagacity, hit on a method of analyzing it and thus demonstrating its nature. Meyer seems to have conducted a line of experiments in the same direction about the time of Bergman's work, and he made his conclusions known to chemists in time to dispute with Bergman a claim to priority of discovery. As may be supposed, Bergman's processes were rude and very imperfect. It was Klaproth who first systematized chemical analysis, and brought the art to such a state that the processes could be imitated by others with nearly the same results in each case. Klaproth analyzed about 200 specimens of minerals and metals, and most of his conclusions were so nearly correct that his successors have, in most cases, confirmed the results he obtained. When he began his researches, chemists were not acquainted with the true composition of a single mineral substance. The service which Klaproth performed for mineralogy in Germany was performed equally well in France by Vauquelin (1763 to 1829). To this chemist we are indebted for a description of the element chromium. All of the early analyses of ores, iron, and steel are credited to one or the other of these two chemists. Vauquelin announced that in steel the carbon percentage averaged $\frac{1}{10}$ th part. By inclosing diamonds in cavities of soft iron and igniting them, they disappeared, and the inner surface of the cavity was found to be converted into steel. I am not aware that this process is employed at the present time, but, judging from the disproportion frequently noted, in experimental steel manufacture, between the cost and the value of the product, one might suppose it is still in use. Berzelius, in the first quarter of the present century, and Ebelmen about ten years later, made important contributions to the knowledge of reagents and methods. Berzelius was the successor of Bergman and Scheele. All previous analyses were revised by him, and modern chemistry begins with his era. One of his iron analyses shows iron 90.80; silicium, 0.50; magnesium,

0.20; manganese, 4.57; carbon, 3.90. The pupils of Berzelius were to a great extent instructors of the chemists of to-day.

Karsten, in 1820, recognized the influence of carbon on iron, and stated his belief that iron and steel constitute a continuous series, there being no distinct lines of separation between them. In his judgment, it was simply a question of carbon percentage where, in the series, a piece of iron or steel belonged. In his *Metallurgy*, published in 1830, he notes the fact that pig-iron contains carbon, silicon, sulphur, phosphorus, manganese, calcium, magnesium, and chromium. It is probable, however, that all these elements had been previously recognized and described. As early as 1815, there was more or less speculation whether hardness and softness in steel were due to physical or chemical causes. Faraday is credited by Percy with having been, in 1822, the first to point out that a piece of hardened steel dissolved completely in hydrochloric acid, while soft steel always yielded a certain amount of carbonaceous residue when subjected to the action of that solvent. David Mushet, in *Iron and Steel* (1840), gives a very good idea of what was known of metallurgical chemistry at that time. He mentions certain ores which contain "phosphat" of iron, which was generally believed to account for the fact that the iron made from them was cold-short. Mushet, however, was by no means certain of the cause of cold-shortness. Phosphorus, he tells us, had long been regarded as the prime cause of this quality in iron; but by the practical observer, this theory could not be considered tenable, for it had always been noticed that the most perfect qualities of iron, notably some of the Swedish makes, gave out in working "a very strong phosphoric smell." Regarding the condition in which carbon exists in iron, Mushet says: "In the works of those who have treated on iron, I have never yet seen carbon which exists in crude iron distinguished from that absorbed by malleable iron in the process of converting it into steel. I could," he continues, "adduce many facts which to me appear conclusive, to prove that carbon exists in crude iron in a concrete state, separable by mechanical division, and that it is united to steel in a gaseous state by the combustion of its base, inseparable in any form by the most minute mechanical reduction." It is surprising to note the earnestness and gravity with which, in 1840, these statements were made. It shows the newness of the knowledge which nowadays serves as the starting-point for discussion on such topics.

Mushet treats very fully of the effect of different substances on the quality of iron. He made a number of experiments by fusing iron with different fluxes in crucibles, and noting the quality of metal produced. One section of his book is devoted to the different proportions of carbon which constitute iron and steel; and he gives the results of fourteen experiments. His method was to fuse a certain number of grains of wrought-iron with charcoal in varying proportions, and note the increase of weight as showing the amount of carbon taken up. Karsten, however, promptly challenged the accuracy of his methods, and proceeded to show that Mushet's tables giving the carbon percentages in iron and steel were entirely wrong—much as chemists of the present day are prone to do upon occasion.

It is unnecessary to follow from this point the progress of metallurgical chemistry toward a scientific basis. Its general employment as a means of assisting makers to control the character of their product concerns us more; and this is almost within the memory of even the youngest of our membership. Most of us can recollect when the dependence of the iron-master and the engineer who cared to know the chemical composition of a piece of iron or steel was upon the general analytical chemist. When the influence of our technical schools began to be felt, and young men well equipped for the work began to displace, in the management of furnaces and mills, those who had gained their knowledge in the school of experience, where the instruction is not always thorough in proportion to the cost of tuition, the laboratory began to be recognized as an essential part of an iron or steel-making plant, and in nearly every establishment with any pretensions to completeness, the chemist has become an important member of the staff. But it is not more than fourteen years ago that this was the exception rather than the rule. Among my letters, I have one bearing date of 1872, written by the general manager of an important iron-works. He says: "The president of our company thinks we ought to follow the fashion and have a chemist. To my mind, it is a waste of money. When I want an analysis, I can have it made—and that is very seldom; for the furnace-manager who needs a chemist to tell him the quality of ore or limestone, or whether his pig-iron is soft or hard, had better resign and go to farming. However, if the president says chemist, chemist it is. My object in writing is to know if you can recommend a young man competent to fit up a laboratory and take charge of it. We have very little society here, and it is desirable that he should be a gentleman. My wife plays the piano, and I do a little on the flute; and if we can get a chemist who plays the violin, we could have some music evenings. If you can suggest a man who combines these qualifications, I could employ him. I do not know what a chemist would expect; but I should not care to pay more than \$10 a week."

When the demand for analytical work in connection with the iron and steel industry began to be felt, it brought into the service of the iron-master a great many clever and ingenious chemists at home and abroad, and a varied and valuable literature of metallurgical chemistry was soon created. The need of accurate analyses was so evident that their importance was perhaps somewhat exaggerated; and for a time it seemed as if we might safely look to the chemist to answer every question which could be raised by the iron-master or the engineer. Our confidence in tabulated percentages of the component parts of a piece of iron or steel resulted largely from the fact that we knew so little what knowledge was needed for a clear and satisfactory explanation of observed phenomena. From this over-confidence in the power of the chemist to explain every thing, there has been a natural and, doubtless, wholesome reaction. Experience has shown that, great as the value of a knowledge of the chemical composition of a piece of metal may be, it is, after all, only a part of the knowledge we need before we can determine with what we are dealing.

To some extent coincident with this rapid progress of chemical investigation, and within even a shorter period, we have seen the development of the physical test, with the aid of appliances that have attained marvelous perfection in surprisingly few years.

Thomas Tredgold, in his *Strength of Cast-Iron*, published in 1823, says: "Lord Bacon's idea of a mechanical history, which Diderot

attempted to realize, is not so well calculated to fulfill his own views (concerning the advancement of the arts) as a well-directed course of experiments on the nature, forms, and properties of materials. In chemistry, much has been done, but an experimental school of mechanical science remains to be formed." Referring to the necessity for more knowledge of physical properties than was at that time possessed, Tredgold says: "The manner in which the resistance of materials has been treated, by most of our common mechanical writers has also, in some sense, misled the practical men who are desirous of proceeding upon sure ground, and has given occasion for the sarcastic remark that the stability of a building is inversely proportional to the science of the builder.

Coulomb, in 1784, made some important experiments on torsion, and was probably among the first to study the effect of continued stress upon the elastic limit of iron and steel. In 1818, Wilson estimated the power required to crush cast-iron, at 2,240,000 pounds to the cubic inch. Reynolds, quoted by Wilson, recorded an experiment in which a cube of cast-iron, one fourth of an inch square, required 448,000 pounds to crush it. Tredgold considered it necessary to correct these erroneous estimates, and made numerous experiments with cast-iron, testing specimens by static loads and under a drop. The results are given in the work before mentioned. He also made some experiments upon wrought-iron, correcting or verifying the results reached with crude methods by various European experimenters between 1758 and 1820. The modulus of elasticity of steel was probably first calculated by Dr. Thomas Young, about 1820, from the vibrations of a tuning-fork. The height of a modulus found by this method was 8,830,000 feet and the weight per square inch was 29,000,000 pounds. That is, a bar of steel 8,830,000 feet in length and 1 inch square in cross-section, would stretch from its own weight to double its original length; and its weight, 29,000,000 pounds, is the modulus of elasticity as ordinarily expressed.

It is within a century that the work of Napier, Perronet, Poleni, Telford, Brunel, and others furnished the basis for a more or less exact knowledge of some of the more easily recognized and described physical properties of iron and steel. Naturally the results reached by these experimenters were as incomplete, and in many instances as mistaken, as their methods and appliances were rude and unsatisfactory. Drop-hammers, single lever testing-machines and hydraulic presses were the only power appliances employed in testing during the first half of the present century. Experiments were mostly directed to ascertaining the tensile strength of materials, chiefly iron, steel, and wood, under shocks or stresses that, at a single application, would produce rupture. The breaking-point thus ascertained was termed the ultimate strength of the material; and until very recently the data thus gathered were the only bases for calculating the dimensions of members that were expected to resist tension. Resistance to compression was similarly determined by the application of crushing loads to cubes of unit dimensions; and this was deemed satisfactory until the experiments of Hodgkinson demonstrated the previously unrecognized influence upon resistance to compression of the ratio of diameter to length in test-specimens.

Among the earlier of the experimenters in this field, Napier is entitled to special prominence. He probably did more than any one else to bring science and practice together and to make one help the other. Napier's theory of rupture under transverse strain, though since found to be correct only within certain limits, is still quite generally accepted as a basis for calculations dealing with such strains. To Woehler in 1858, we are indebted for a knowledge of the influence of the repetition of quiet stresses. This led to the formulation of Woehler's law, that rupture may be caused by the frequent application of stresses in no instance approximating the original ultimate strength of the metal. The recognition of this law established the significance of the elastic limit in the calculation of dimensions, and marks what is probably the most important epoch in modern methods of dimensioning.

In 1862, Kirkaldy published his *Results of an Experimental Inquiry*, etc., which effected a considerable modification of the views previously held by engineers as to the physical characteristics of materials, especially of steel. These investigations tended in a material degree to popularize experiments with construction materials in the testing-machine, and created a demand for such machines and for accessory apparatus for measuring elongation, etc. The Messrs. Fairbanks were, I believe, the first to produce, in 1863, a testing-machine on the multiple-lever principle, and though of limited capacity, this was an important improvement upon previous constructions. They were quickly followed by Riehle Brothers, whose testing-machines still hold a high place in the estimation of experimenters. The next great step forward was marked by the production of Thurston's automatic-recording torsional testing-machine. The progress continued until it culminated in the Emery testing-machine, probably the most remarkable instrument of precision ever built, and the most improved type of which dates no further back than 1880. In the line of automatic-recording apparatus, the latest form, devised by Abbot, illustrates the high development attained in the construction of testing-machine accessories.

The period from 1850 to 1875 was, without doubt, the most fruitful in additions to our knowledge of the physical properties of iron and steel as revealed by the testing-machine. It comprised the investigations of Napier, Fairbairn, Woehler, Spangenberg, Kirkaldy, and Thurston. The work of these and other investigators brought the physical laboratory fully abreast with the chemical laboratory, and each has given to work done in the other a value it would not otherwise have possessed. But he who should undertake the study of iron and steel with no other light than that which analysis and test can give him, though he would learn much of value, would find himself baffled at every turn by mysteries which these methods of investigation can not solve. This is especially true of steel. In my experience, very few of those who make or use steel are prepared to accept the statement that chemical analysis alone can be relied upon to determine its quality. It may be broadly stated, that certain compositions never make good steel; but the reverse can not be asserted with equal confidence. With a given composition, the result depends primarily upon the perfect admixture of the ingredients. Imperfect melting will give an unsatisfactory product, no matter what the stock used or the composition shown by analysis of the ingot. It will also be questioned by many, whether a method of accurately determining the oxide of iron in steel would materially increase the confidence

we should feel in a judgment of quality from analysis. It is true that chemical methods are becoming more rapid and accurate every day; but with as complete a knowledge of the stock from which steel is made as chemical analysis can give us, there still remain a great many uncertain factors in the equation of quality. In fact, it seems that the value of ingot-analysis may easily be very much exaggerated, and that within certain limits the physical structure of a piece of metal is quite as important to be known as its chemical composition. There are many gentlemen in this audience who could substantiate, by the results of long experience, the broad statement that, without good melting and proper subsequent treatment of the ingot, good steel is impossible with any admixture of ingredients which the chemist may prescribe. Chemistry has its limitations—not quite sharply defined perhaps, but still evident. If the chemist should ever succeed in giving us a report showing the exact proportion of each constituent of a piece of metal, beyond question or doubt, we might still be in the work before us where the builder is when he stands among his bricks and lumber and the sundry materials he makes use of in construction. If he knew nothing more than the count and tally of his materials, he could build nothing.

Nor is the testing-machine infallible. What it shows is, to a greater or less extent, dependent upon what the operator seeks to have it show. We all know how, on the one hand, by sudden shock applied to a specimen under stress, it can be made to give results far below any recognized standard; and how, on the other hand, by gentle increments of stress through lengthening intervals of time, a piece of metal may be coaxed to show test-results far above its real value, and apparently inconsistent with its chemical composition. But even when it is possible to have such confidence in a physical test as can only result from a knowledge that every thing connected with it has been honest and fair, and surrounded by safeguards against every known source of error, we must look elsewhere than to the chemist for an explanation of many of the phenomena which the testing-machine reveals. If we seek to compare the results of physical and chemical test, we shall become hopelessly confused. Generalizations warranted by one relation of composition to quality will often be contradicted by a different relation; and we should reach the almost despairing conclusion that one or other of these methods must be accepted as the sole standard by which to judge quality. Which we should choose, would depend upon whether we had formed our opinions in the laboratory or in the mill.

To harmonize what seem to be the often conflicting results of chemical analysis and physical test, we must seek for a knowledge of causes affecting quality in yet other directions. In this, we have already had assistance of the greatest value. The anomalies developed by the steels made by different formulae, and of samples of a given composition taken at different stages in the process of manufacture, have called attention to the fact that the quality of steel does not alone depend upon what it is made of.

In 1873, the building of three large iron-clads was begun at Brest and L'Orient, and steel was largely used in their construction. Lieut. J. Barba, Chief Naval Constructor at L'Orient, investigated some of these anomalies, and to him we are indebted for the first exact observation of the effect of manipulations upon steel. Barba's work was ably supplemented by that of Joessell and continued by Pourcel, Holley, Metcalf, Hill, and others, with the result of showing that the influence of manipulation in processes of manufacture is of prime importance in its relation to the quality of the finished product. It is important to know the chemical composition of muck-bar and ingot, but experiment and experience have shown that the beam, the rail, the ship-plate, and the bridge-member on which the safety of the whole structure may depend, may be so far below the standard of quality which analysis would lead us to expect or physical tests of specimens taken at intermediate stages in the process of manufacture warrant us in assuming, that we must seek still further light on the subject in the revelations of microscopic analysis. In the microscope, we have an instrument which promises to supplement the laboratory and the testing-machine, to harmonize their seemingly conflicting records, and to detect the influence of shop-treatment at every step in the process of manufacture. The work of the microscopists who have thus far turned their attention to iron and steel, has not been complete enough, as yet, to give us more than a few standards by which to compare our observations; but I do not doubt that within a very few years the microscope will give the laboratory and the testing-machine a value for the iron-master, the steel-maker, and the engineer incomparably greater than that they now possess. This branch of special investigation is one which offers many attractions for the conscientious student who will approach it in the earnest spirit of scientific inquiry. Within the little circle of the field of a microscope, there is more to be learned of value to science and the arts than the chemist can predict or the physicist explain. It will bring us to the point beyond which no investigation can proceed. Then, as now, we shall realize that "the utmost still is hid;" but when we shall have learned all it is possible to learn from the revelations of the microscope, we shall have followed truth to the limit of human intelligence, and seen it fade into infinite mystery.

Meanwhile, let us remember how new is our knowledge of iron and steel, how incomplete and how dependent is the student by one method upon the knowledge gained by other methods, some as yet almost untried. It is too soon for broad generalizations. The key to the mystery seems to lie in the structure of the metal; and until we know more of this, and can reason from effect to cause through the known phenomena of analysis and test, we may safely distrust that assurance of conviction and positiveness of utterance which Tyndal tells us are ever characteristic of "the confidence of half-knowledge."

The secretary then read a paper by Professor S. B. Christy, of the State University of California, Berkeley, on

THE MINERS' FUND AT NEW ALMADEN.

where the great distance from the nearest town, San José, and the consequent high charges of physicians, led to an early attempt to provide for a fund. In 1864, the management of the New Almaden quicksilver mine made an effort, but failed, because of the opposition to the innovation. In 1870, the miners themselves started a system of voluntary subscription; but this plan, too, though it worked well in the beginning, gave rise to dissatisfaction, because many of the miners were not contributors and still received nearly as much benefit as those who did pay. The number of contributors decreased steadily. But, after Mr. J. B. Randol became

general manager, in 1870, he arranged for a fund at the petition of the men, and gradually developed the system, now in force, and controlled by the following basis:

I. Employés of the Quicksilver Mining Company, heads of families, and all other adults residing at New Almaden, shall pay monthly into the fund one dollar. The money so contributed is held by J. B. Randol, trustee, to be paid out for the following purposes: 1. The salaries of a resident physician (\$350 a month), and of a druggist, and for the purchase of medical supplies. 2. The relief of contributors whom circumstances may entitle to the same, and for other contingent expenses.

II. Contributors are entitled, without further payment, to the attendance of the resident physician for themselves and their immediate families (except that cases of confinement will be charged \$5), and will be furnished with medicines prescribed by him on payment of cost.

III. When the fund is subject to any expense for relief of persons indigent or otherwise—say for medicines, nurses or supplies—it will be regarded as in the nature of a gift, or as an advance to be repaid, as the trustee may decide to be just, considering the circumstances of each case.

IV. It is expressly agreed that, when the resident physician is called to attend any person not a contributor to the fund, there shall be a charge of not less than five dollars for each visit, to be paid into the fund and to be charged against and collected from the head of the house where such non-resident may be living.

V. The trustee serves without pay, and in consideration thereof it is understood that the foregoing rules and regulations will be observed by all persons interested therein, and it is expressly agreed that all sums due or to become due to the fund by the contributors, or any of them, shall be a lien upon any property of the contributors at New Almaden, and upon any money due or to become due them for wages from the Quicksilver Mining Company, which money said company is authorized to pay over to the fund without further notice.

Some of these rules were passed with special reference to the peculiarities of the Spanish-American population of New Almaden, who were frequently in the habit of drawing double the value of their contributions in medicine, and who imported non-resident distant relatives for treatment at the hands of the physicians.

A complete record of the fatal accidents during the last thirteen years has not been kept; but in the last four and a half years there were nine, on an average of 440 men employed, or less than one half of one per cent annually. During the last four years and a half, the highest annual mortality from all causes was 15 per 1000 inhabitants, and the lowest 11 per 1000. Cases of salivation never occur at the furnaces except in cases of extreme carelessness, the chief trouble in the works being from cleaning the condensers and working the soot. Formerly, there was little trouble from salivation in the mine, when cinnabar ore was extracted. At present, in working the rich "labores" of the 1600 and 1700-foot levels of the Randol shaft, which contain a great deal of native quicksilver, there is more trouble, due, however, to the fact chiefly that the men used to strip to the waist. Since they have been compelled to wear their shirts while at work, the number of cases has diminished.

The following summary, from 1874 to 1884, of the monthly reports of physicians will give an idea of the amount of work done:

Number of patients visited.....	42,156
" " visiting office.....	41,238
" " Vaccination.....	729
" " Salivation cases treated.....	26
" " Confinements.....	209
Total cases.....	84,358

The following is a summary of the receipts and disbursements for the thirteen years, ended December 31st, 1883:

RECEIPTS.	
From Collections.....	\$80,447.30
Sale of medicine.....	2,484.00
Obstetric cases.....	1,280.00
Interest.....	2,551.50
Miscellaneous.....	504.25
Total.....	\$87,357.05
DISBURSEMENTS.	
Salary of physicians.....	\$47,711.00
Medical stores.....	13,283.11
Contributions to sick and disabled.....	4,019.24
Commissions for collector and secretary.....	3,842.34
Hospital nurses.....	1,648.00
Livery.....	1,425.78
Miscellaneous.....	7,592.64
Total.....	\$79,522.11
Deposits and cash.....	7,834.94

This shows a cost of treatment per case of 44 cents, and of total cost of 72.5 cents per visit, including all expenses.

Mr. W. F. Durfee, of Bridgeport, Conn., read a paper on a "Vacuum Pump and Table Blow-Pipe," a very convenient arrangement for laboratory use. In the discussion, Professor Dr. Persifer Frazer referred to Professor Richards's similar apparatus.

Mr. John Birkinbine was then called upon to make some remarks on the Cerro de Mercado or Durango Iron Mountain, Mexico. We have in the past referred to this wonderful iron deposit, whose location, extent, and characteristics were referred to at some length by him.

COMPETITIVE TESTS FOR SAFETY-LAMPS.—Some time ago, Mr. Ellis Lever, of England, offered a prize of £500 to any one who should invent a mining lamp that should fulfill certain requirements that would render its use almost absolutely safe under the most trying circumstances. Between sixty and seventy lamps have been sent in from inventors in England, the United States, Belgium, Germany, and France; and the judges, of whom Mr. Burt, M.P., is chairman, is now about to begin its examination. The apparatus used at Woolwich by the Royal Commission on Mines has been placed at its disposal, and by the aid of this machinery it will be possible to test the lamps under all the conditions to which they are likely to be subjected when in actual work. Mr. Lever offered the prize for one lamp only, but the Miners' National Union will add another prize of £100 for the lamp that shall be judged second best.

THE PITTSBURG MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—II.

Mr. W. Barnet le Van, of Philadelphia, in his paper, NEW YORK TO CHICAGO IN SEVENTEEN HOURS, proposed to show that the 908 miles between these two cities could be covered in the time specified in the following manner, via the Pennsylvania and Pittsburg, Fort Wayne & Chicago railroads:

	Miles.	Minutes.
New York City to Philadelphia, Mantua Station.....	88.26	in 100
Philadelphia to Harrisburg.....	103.07	in 114
Harrisburg to Altoona.....	131.60	in 144
Altoona to Pittsburg.....	116.70	in 128
Pittsburg to Alliance.....	83.00	in 91
Alliance to Crestline.....	106.00	in 117
Crestline to Fort Wayne.....	131.39	in 144
Fort Wayne to Chicago.....	148.00	in 162
Total miles.....	907.91	
Total time in minutes.....		1,000
Crossing at grade via in Ohio.....	16	
" " " " Indiana.....	10	
" " " " Illinois.....	8	
Total number of crossings at grade.....	34	
Time lost by slowing down according to law.....		20
Total number minutes consumed.....		1,020
Total time of run to Chicago in hours.....		17.00

He gave a number of diagrams from the locomotives of the Pennsylvania Railroad at different speeds, to show that they were capable of performing the journey. He pointed out that the diagrams showed only an average of 65 per cent of the theoretical diagrams, while diagrams from stationary engines of similar capacity with automatic cut-off show an average of 90 per cent—a difference due to the use of the link motion in locomotive engines. He argues that this great loss would be overcome by the substitution of a separate cut-off valve similar to that adopted by Mr. A. J. Stevens, of the Central Pacific Railroad. He states that this substitution would cost about \$300 for each engine, and that about 33 per cent of additional working power would be gained by it.

This paper was followed by a paper by Dr. Charles E. Emery, entitled

ESTIMATES FOR STEAM USERS,

in which he gave the rules on which the estimates of the New York Steam Company have been based. The problem of fixing a unit by which steam could be sold was solved by the adoption of the customary standard of thirty pounds of feed-water per horse-power per hour; but as confusion might arise in the minds of consumers between pounds of water evaporated into steam and pounds of steam pressure, a new unit seemed necessary, and the one chosen was the "Kal," equivalent to a pound of water evaporated into saturated steam—a seventy pounds pressure from a temperature of 100 degrees Fahr., with a thermal value of 1110.2 thermal units, a "commercial horse-power" being equal to 30 kals per hour. The regular water rate is placed at 60 cents per 1000 kals, which is reduced to 50 kals for considerable amounts, and when the consumption can be accurately ascertained. The cost of heating buildings ranges from \$2.50 to \$5 per thousand cubic feet per season of 200 days of ten hours. For power, a series of formulæ is submitted, and rules are given for ascertaining the charge for hydraulic and steam elevators, steam-pumps, and water-jets.

There was a brief discussion, and after Mr. H. R. Towne, of Stamford, had read his paper, "A Drawing Office System," and Mr. O. Smith had given a description of "A Positive Speed Indicator," the meeting adjourned.

ON PRECAUTIONARY MEASURES AGAINST EXPLOSIONS OF FIRE-DAMP.—VI.*

By M. Hoernecke, Halle, Germany.

Opening Out.—It is a mistake to allow the ventilation in workings for opening out fiery mines to be accomplished by diffusion. Although it has led to many accidents, it has, by indulgence, almost become the general practice. In reality, it is necessary to follow closely the workings for opening out by ventilation produced by artificial means, because marsh-gas in many cases develops more abundantly than during the work of extension proper, and because it is easier to supply fresh air to the latter than to the former.

The means available for conducting and distributing a current of fresh air to this class of workings are doors, partitions, or partings, pipes, and drill-holes, and in some cases a separate system of ventilation, with the aid of compressed air, may, in some collieries and soil, eventually supplant the main current of air.

Doors are used for interrupting the current of air, in order to deflect it partially or entirely. In the former case, they are provided with suitable openings, and in the latter they must be constructed with the greatest care, or, better still, a number of doors are put at suitable distances from one another. Doors are put in only when a drift or gallery must be kept open. When this is not the case, it is much safer to close the gallery by a dam, and thus cut off the current. When the purpose for which a door was put in ceases, it is better to take it out entirely rather than to leave it open, because by accidental or careless closing it may lead to very dangerous consequences. Well closing doors have planed frames, the connection of which with the walls of the drift is carefully rendered air-tight. The doors, also, must be made of well planed and doweled boards, and in special cases it is advisable to use rubber strips. At the most important points, boys are stationed to close the doors, otherwise the frames are so inclined that they close of themselves. When doors are intended to close wide galleries, or it is necessary that they should open in both directions, in order to allow full or empty cars to pass in both directions, they are so constructed that they swing on a vertical axis in the center, or they are made of two parts, or there are two doors hinging on a central post, one of them opening in one direction and the other in the contrary direction. When doors need

* Verhandlungen des Vereins für Beförderung des Gewerbfleißes.

openings to allow a part of the current to pass through, they are provided with slides in their upper part, in order to force the current to move along the roof where the fire-damp tends to accumulate. It is good practice to put the slides in that side of the door at which the fresh air enters or from which the vitiated air comes, because fire-damp easily accumulates in the dead space below the slide, where it can be easily ignited when the slide is regulating.

When the pressure of the ground is great and in galleries in which there is no haulage, in air-drifts, therefore, doors are used in Westphalia consisting of boards set up on edge and sliding between guides made of strips of wood. When the current is to be split, the upper boards are taken out. At Luisenthal, in the Saarbruecken District, the latter object has been successfully attained by closing the lower part of the drift by cloth. In many cases, it is customary, in difficult ground, and where drifts advance rapidly, to use, instead of doors, duck curtains, tarred or not. They do not, however, close tightly, and are easily blown open by a strong current of air.

Partitions are generally put in vertically throughout the entire depth of the shaft or the length of the drifts to be ventilated, in order to conduct the current in one direction in the portions thus formed and back in the other. They are made of masonry, boards, or cotton duck. Masonry partitions are used for more permanent purposes; but they take much room, are costly, and can not be kept tight for any great length of time. Board partitions are cheaper, but are less effective so far as tightness is concerned, and are less desirable. In ground showing a good deal of pressure, and when the gallery advances rapidly, cloth partitions, spread over wooden frames, are largely used. They are more expensive than those made of board, but cheaper than masonry, are rapidly put up or moved, and are, therefore, generally used in England.

Partitions are not advantageous, because, on account of the haulage, they can only be put into double-track galleries, and into them only when the dip of the seam is not too great, as otherwise they must be put near the upper side. When the dip is steep, horizontal partitions are put into high and narrow drifts.

In narrow drifts that will not bear subdivision, and where there is little space, pipe is employed. Formerly pipe was generally made square in section, of boards, but in this form they are not very durable, cause great friction, and give rise to much lost space on the corners. Therefore, nowadays, pipe of circular section made of sheet-zinc or galvanized iron is generally employed.

Zinc air-pipes are generally 7 feet long, the diameter varying according to the requirements of each special case. The ends are pushed into one another and the joints made air-tight with grease, clay, or cement. Probably rubber bands held in place and enforced with an iron ring would be best. Such a joint, too, would admit of movements in the pipe-line without leading to leaks.

Ventilating pipes may serve either to carry fresh air to the face or to carry away vitiated air from it. In both cases, when the ordinary ventilating current is used, doors must always be up in the gallery conducting the air in case of blowing-pipes, and on the drift taking off the vitiated air in the case of exhausting-pipes.

Blowing-pipes conduct pure air to the face, without its being impregnated with moisture on its way, a point which is of much influence upon their velocity, because the flow of the gases under equal pressure is inversely proportional to the square roots of their density. Now, as furthermore, the pipes must, on account of the firing of shots and the working at the face, be kept at some distance from it, to avoid injury to them, the current of air from blowing-pipes with its momentum can reach the face and facilitate the diffusion of the marsh-gas by increasing the column of air in front of the pipe. In the case of exhausting-pipes whose orifice is at the like distance from the face, a body of air at rest stands in the face which it is difficult to ventilate, because the fresh air slowly drawn in through the open drift immediately flows into the orifice of the pipe without reaching the face of the drift. With exhausting-pipes, the fresh air, flowing through the entire length of the drift, is vitiated by the gases escaping from its walls. Still they are used in preference where it is a question of carrying dangerous gas away from the face directly to the air-drifts.

Harzé calculates that the efficiency of blowing-pipes is greater by 4 per cent than that of exhausting-pipes, because the latter require at least one elbow to carry the air into another drift, and that it is greater by 14 per cent when there is an admixture of fire-damp in the proportion of one to thirty, because the volumes of gases at the same pressure carried by pipes is inversely proportional to their density.

The losses in the passage of air through pipes are due to leakages and to friction. The former can not be determined beforehand, but by good work they may be reduced to a minimum. The latter are computed as follows by Foerster, in millimeters water pressure :

$$Z = \frac{76}{100} \times \frac{l}{d} \times a \left(5 + \frac{1}{d} \right) u^2 \times 10334,$$

a formula in which *l* is the length of the pipe, *d* is its diameter, *u* the velocity in meters per second, *a* is the weight of one cubic meter of compressed air in kilograms at 20 degrees Celsius.

Further losses are occasioned by elbows. According to Pecllet, they are calculated as follows :

$$P - p' = p \times \sin. ^2 i,$$

in which *P* is the quantity of air before the elbow, *p'* that behind it, *p* is the quantity corresponding to the velocity, and *i* the angle of the elbow, which must range between 90 and 160 degrees.

According to these formulæ, the resistance in pipes increases principally with their length, and in proportion as their diameter diminishes. Therefore, the depression must be made correspondingly greater if the current branched off by pipes alone is to be brought to the face with sufficient velocity. In order to create this greater depression, the total depression of all the other currents must be brought to the same point, and the ventilation be accordingly increased, or the same resistance must be opposed to all the other currents, and in that manner the entire ventilation would be obstructed in an unprofitable manner. It is more advantageous, therefore, to put up a special apparatus for long pipes for the

current offering the greatest resistance. For this purpose, small ventilators, worked by hand or by a motor, are particularly suitable.

Air drill-holes, like pipes, serve to ventilate the ground between headings, and are drilled at suitable points in the seam itself. Their surface is rougher, and they can not serve their purpose at other points. In spite of these drawbacks, they are widely used, particularly in Westphalia. Special machines for drilling them are employed there, the most prominent being those of Pelzer, Heintzmann & Drayer, and Munscheid. The holes drilled with all these machines afford the great advantage that it is possible to connect quickly different drifts for the purposes of ventilation, and that when uprisers are driven, after they have been drilled, they render that work less dangerous. In flat seams, with varying dips, and in hard coal with partings of slate, they can be rarely put through; they choke up easily in soft coal, and then become dangerous reservoirs for the accumulation of fire-damp. Their section is too small for conducting the entire current of air from one level to the other, and the great friction due to their rough walls brings their efficiency down to the level of poorly constructed pipes. As independent air connections, they must therefore be rejected, but they can do good service when drilled ahead of uprisers.

The employment of compressed air for ventilation is gaining ground recently, since it is used in driving underground rock-drills and winches, and compressors must become a part of the plant to drive them any how. The action of the air already used in the machine that it has driven is a very simple one, as in exhausting it expands, and lowers the temperature in expanding. In order to transmit it to longer distances, the exhaust-pipe, especially of stationary underground hoisting winches, is allowed to enter pipes as wide as possible, in order to avoid any excessive back pressure, and then the exhausting air carries with it a further considerable volume of air from the vicinity of the orifice of the pipe.

The French Fire Damp Commission has rejected, as a means of ventilation, the idea of conducting compressed air from the compressor, or from pipe in the main pipe, to the individual working places, and of blowing it out there directly, because it is either necessary to carry the same amount of air to the working faces as in ordinary ventilation, and then the pressure of the compressed air is useless, or even injurious, or otherwise a much smaller volume of air would be conducted to it, which then would fail to fulfill the object of sufficiently diverting the flow of marsh-gas.

Chauselle even claims to have observed that, in a drift filled with smoke, jets of compressed air made holes in it, as it were, and then, by reason of their lower temperature, due to expansion, fell to the floor, along which they flowed like a stream, carrying very little vitiated air with them.

These drawbacks may be partially overcome by allowing the compressed air to flow out near the roof of the drift, and in shafts and drifts with a strong grade, the fall of the cooled air to the floor can only be regarded as desirable. Therefore very satisfactory results have been obtained in Saarbruecken and Saxony with this method in workings for opening out the seam, when the quantities of marsh-gas and carbonic acid were heavy. By allowing the air to blow out of the pipes, a strong agitation is produced at the face, which may dilute the dangerous gas upon its escape from the seam, so as to make it at once harmless to the workmen. As in the case of blowing-pipes, the advantage over bringing to the face the same volume of air over the entire section of the drift lies in the fact that in case of the latter it reaches the face with a much smaller velocity than with the ventilation by means of pipes.

What, however, makes the direct blowing out of compressed air less worthy of being recommended is its high cost, which is considerably increased by heavy losses of pressure in the pipe-line, so that the friction in the long and narrow pipe may consume the entire mechanical energy expended in compression.

A less expensive and more efficient means of utilizing the compressed air is reached when it is allowed to act only as a motor in a special ventilating apparatus, and in this respect the Körtling injector has proved advantageous. In it, the compressed air is blown out only in a thin jet, by which, at Zankeroda, so much air is aspirated and carried along that the quantity of the compressed air used is increased 5.15 fold with 30 pounds pressure, 5.81 fold with 45 pounds pressure, and 6.64 fold with 60 pounds pressure. In a manner similar to that at Zankeroda, a Körtling apparatus, in the Worm District, delivers a 5 to 6-fold volume of air through a 20.5-centimeter pipe, with a jet of compressed air at 75 pounds pressure in a 25-millimeter pipe, and Körtling apparatus are used under similarly favorable conditions in the Saarbruecken District.

According to Foerster, a more complete arrangement for a special ventilation with compressed air is made by tapping a small quantity of air from the main pipe, and driving a small compound engine with it to run a Root blower, from which the air is carried in pipes to the face to be ventilated. In this manner, 26.6 and 30.9 times more air is delivered than the amount used for driving the compound engine with compressed air having a pressure of 3.18 and 3.68 atmospheres respectively.

No investigations have been made anywhere else but at Zankeroda on the results of using a Root blower driven by a compressed air motor. According to the experience gathered there, the running working expenses of producing compressed air of 4 atmospheres pressure, reduced to 1 cubic meter at ordinary pressure, compare as follows :

	Running expenses.	Running expenses, including interest on plant.
Compressed air blown out directly.....	0.350 Pfennige.	0.414 Pfennige.
Using Körtling apparatus.....	0.053 "	0.071 "
Using compound engine and Root blower....	0.011 "	0.017 "

THE TEMPERATURE OF WATER AT VARIOUS DEPTHS.—Mr. D. J. Whittemore, President of the American Society of Civil Engineers, referred, at a recent meeting of that body, to the fact that cold water is frequently obtained by mariners upon the great lakes by sinking a corked jug to some depth, and then, by withdrawing the cork, the jug is filled with water very cold and refreshing. Observations on the temperature of the water at various depths in Pine Lake, Wisconsin, were also presented. Temperature observations on Lake Superior show comparatively constant temperature at the bottom of about 39 degrees and in depths from 400 to 100 feet.

WATER-POWER WITH HIGH PRESSURES AND WROUGHT-IRON WATER-PIPE -I.*

By Hamilton Smith, Jr., M. Am. Soc. C.E.

For the purpose of supplying the placermines in California with water, many ditches were built on the western slope of the Sierra Nevada, taking their source high up in the mountains, and delivering the water on the tops of the foot-hill ridges, at elevations from 1000 to 3000 feet above the great valley of California, formed by the Sacramento and San Joaquin rivers. In many cases, the mines for which these aqueducts were constructed have been exhausted or abandoned, and their water is now largely used for power for quartz mining and milling, and for other purposes.

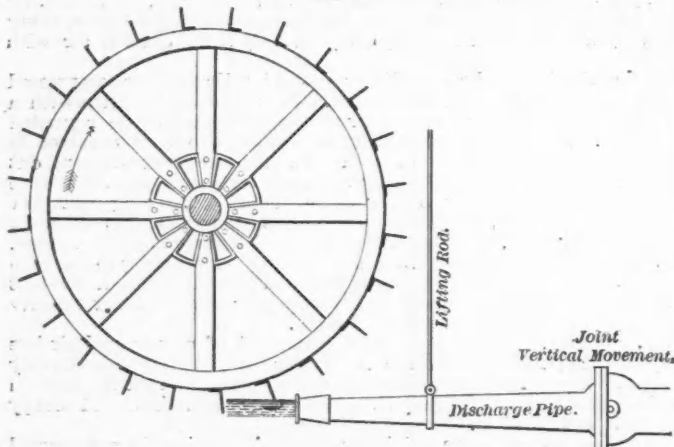
When manufacturing in California assumes large proportions, doubtless most of the motive-power will be obtained from these mining ditches, which in the aggregate will afford several hundred thousand horse-powers.

The problem presented has been in general the utilization of a small quantity of water—as few of these ditches carry more than 70 or 80 cubic feet per second—with high heads ranging from 200 to 600 feet. The Barker reaction wheel (or mill) was first used to a limited extent, but was soon abandoned, owing to its uneconomical use of water. Turbines were then employed, but with unsatisfactory results, as the great speed of the wheel-shafts, due to the velocity of high heads, resulted in excessive wear and tear upon the bearings of the wheel-shafts, and also upon the gates and guides. Partial turbines, or tangential wheels,† were used with better success. In some cases, large over-shot wheels were built, one at the Sierra Buttes mine having a diameter of 65 feet. A wheel of very simple form, called the "hurdy-gurdy," was introduced some twenty years or more ago, and has almost entirely superseded other hydraulic motors; it has been improved from time to time, until the latest models give an astonishingly high percentage of useful effect. The first part of this paper will be devoted to a description of various styles of the hurdy-gurdy wheel, and an account of some of the methods by which the water is conducted to them, and the power transmitted from them.

THE HURDY-GURDY WHEEL.

The hurdy-gurdy, as first used, was a narrow wooden wheel or disk, built upon a cast-iron spider keyed upon the wheel-shaft, as shown by Fig. 1. The faces of wheels of considerable diameter were from 4 to 6

Fig. 1.



inches wide; the buckets were square iron castings bolted to the rim, against which the water escaping under pressure from the nozzle impinged. Wheels of this sort were made as large as 21 feet in diameter; when of this size, they were sometimes stiffened by light iron tie rods, running from the rim to collars upon the shaft. With high heads, the face was banded with wrought-iron, to prevent the jet from splintering the wood. This simple type possessed the following advantages:

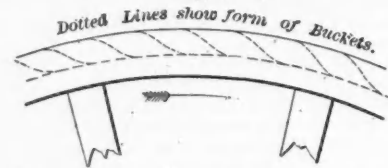
- First. Small cost of construction.
- Second. Comparatively light foundations were required.
- Third. Slow speed of wheel-shaft with high heads, which could be modified at will by change of diameter.
- Fourth. Horizontal wheel-shaft, obviating the necessity of bevel gearing.
- Fifth. The weight of such large wheels, with a high velocity at the rim, was of service in steadying motion of machinery driven, thus affording a cheap form of fly-wheel.
- Sixth. Almost absolute immunity from accidents, the wear and tear being practically nil.

These advantages are common to all the forms of the hurdy-gurdy now in use, with the exception of that due to the large wheel. With this flat bucket, the impact force of the jet was only in part utilized, which in no case could be over 50 per cent of the theoretical power of the water; in practice, an efficiency of not over 40 per cent could be obtained. The most advantageous periphery speed, measured on the center line of the buckets, was about 45 per cent of the velocity of the escaping jet due to gravity ($\cdot 45 (2gh)^{\frac{1}{2}}$). Mr. Ross E. Browne, of the University of California, with such flat buckets, obtained 40.4 per cent as the maximum useful effect on the wheel-shaft, with a periphery speed of about one half the velocity of the escaping jet (doubtless measured at smallest diameter of the nozzle). A $\frac{3}{4}$ -inch nozzle was used, with a head of 50.2 feet, in this experiment. D'Aubuisson describes somewhat similar horizontal wheels as being frequently used in the Alps and Pyrenees, the water being led

* Read before the American Society of Civil Engineers.
 † These wheels are really modifications of the hurdy-gurdy; the jet generally striking on the inside of the rim, against fixed curved buckets.
 ‡ Bulletin No. 1, College of Mechanics, University of California, 1883; by Prof. F. G. Hesse and Ross E. Brown: to which valuable contribution on water motors, reference will several times be had in this paper.

to them by steeply inclined troughs. Probably the use of a jet, escaping under high pressure from a pipe, is a California invention or modification. The first improvement upon this simple form consisted in putting flanges on the sides of the rim, with curved sheet-iron buckets between, as shown by Fig. 2. A number of experiments were made by the writer

Fig. 2.



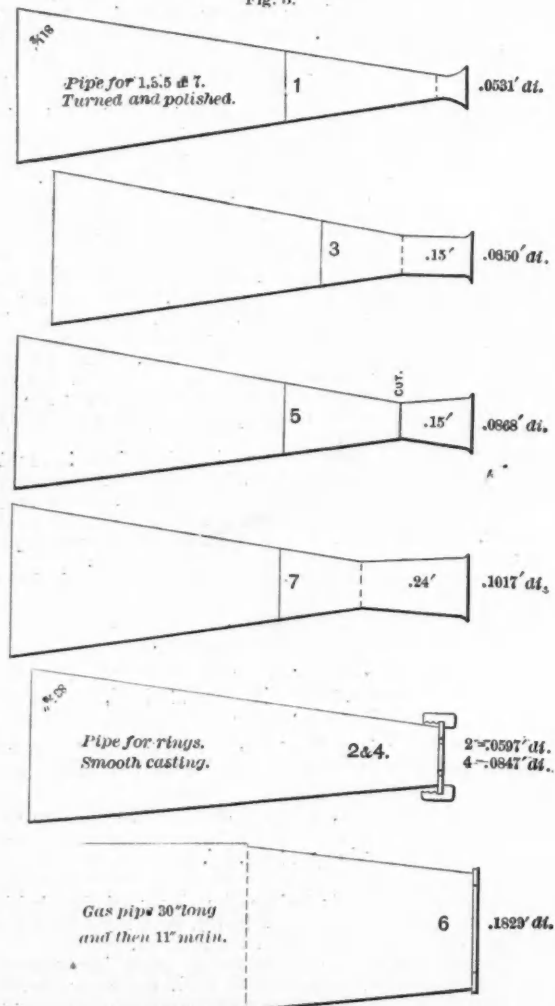
with a wheel of this pattern, 17½ feet in diameter; effective heads from 312 to 336 feet; with buckets 4 inches deep, 4 inches wide, set 12 inches apart. Nozzles of various kinds were used; some with a taper, giving a coefficient of discharge from .944 to about 1; and others with square-edged thin steel ring set in the end of the discharge-pipe, whose coefficients of discharge ranged from .60 to .64.

EXPERIMENTS SHOWING DISCHARGE OF WATER THROUGH VARIOUS CIRCULAR NOZZLES AND RINGS, 1874.

No.	No. of nozzle or ring on sketch.	Diameter.	Effective head.	Q.	Velocities of jet.			Remarks.
					Actual.	Theoretic.	Coef. of discharge.	
1	1	.0531	322.3	.323	145.8	144.0	1.012	
2	3	.0850	314.4	.774	136.4	142.2	.959	
3	3	.0850	312.1	.759	133.7	141.7	.944	
4	5 uncut.	.0868	316.1	.813	137.4	142.6	.963	No. 5, uncut.
5	5 cut-off.	.0868	332.6	.831	140.4	146.2	.960	No. 5, cut at smallest section.
6	5 cut-off.	.0868	325.9	.833	140.8	147.0	.958	
7	7	.1017	317.9	1.111	136.8	143.0	.957	
8	7	.1017	315.6	1.110	136.7	142.5	.959	
9	2 ring.	.0597	316.3	.240	85.7	142.6	.601	
10	4 "	.0847	312.6	.511	90.7	141.8	.640	
11	4 "	.0847	312.2	.509	90.3	141.7	.637	
12	6 "	.1823	130.1	1.528	58.5	91.4	.640	Total head in this experiment.

The nozzles and rings are shown by sketches in Fig. 3. The nozzles and discharge-pipe into which they screwed were of cast-iron, first

Fig. 3.



turned and then smoothly polished. The rings were of saw-plate steel, with square edges; the discharge-pipe, at the end of which the rings were set—Nos. 2 and 4—was a smooth casting. The effective heads for Nos. 1 to 11, inclusive, are given within 2 feet of the truth. Q, for Nos. 1 to 11, was determined by the flow over a sharp-crested iron weir, .866 feet long, by formula of J. B. Francis, modified; the chances are, that Q

is underestimated 2 or 3 per cent. Diameters were measured at smallest section of nozzles. These experiments indicate that with great heads divergent mouth-pieces or adjutages have but slight effect. No. 5 had a divergent end of a length 1.8 times diameter, and gave coefficient of .963; when cut at smallest section, coefficient remained .960 and .958. No. 7, with a divergent end of a length 2.4 times diameter, had a coefficient of .957 and .959. The annular square-edged mouth-pieces were narrow, especially Nos. 4 and 6, and yet show a nearly full contraction of the escaping jet.

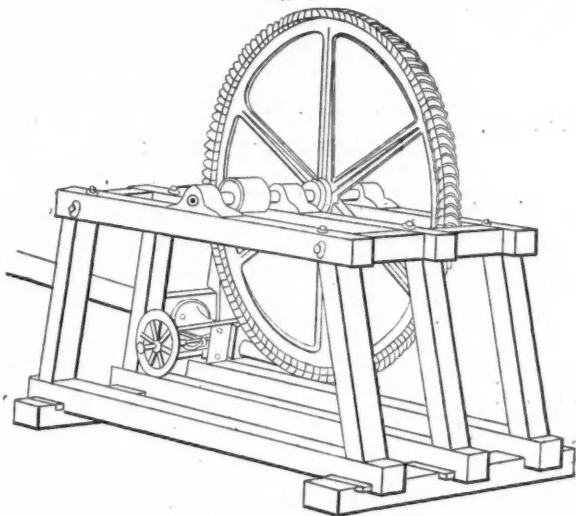
The jet through the rings gave a somewhat better effect than from the tapered nozzles, although the jet was slightly farther away from the wheel with the ring nozzles than it was with the tapered ones.

With small nozzles, the maximum useful effect was about 35 per cent, with a bucket speed of $.35 (2gh)^{1/2}$; with larger nozzles, the maximum efficiency was about 46 per cent, with a bucket speed of $.45 (2gh)^{1/2}$. The highest power developed in these experiments was 17 horse-power, which, for such a heavy wheel as that used, was too little work to show the greatest efficiency.

These tests proved that the best bucket speed depends not upon the velocity of the jet, measured at the smallest area of the nozzle, but practically upon the velocity due to gravity. The ratio of best speed to $(2gh)^{1/2}$, for the same amount of work done, was about the same with the rings as with the tapered nozzles, although the velocity at the smallest section of the nozzles was one half greater than through the rings.*

A similar wheel—diameter 12.58 feet, total head 130.1 feet, ring nozzle .1823 foot in diameter, driving a 10-stamp crushing-mill, average weight of stamp 693½ pounds, average drop .768 feet, number of drops per minute 62.2—developed 10 horse-power of actual work, showing an efficiency of 44½ per cent. Allowing for loss of head in pipe and friction

Fig. 4.

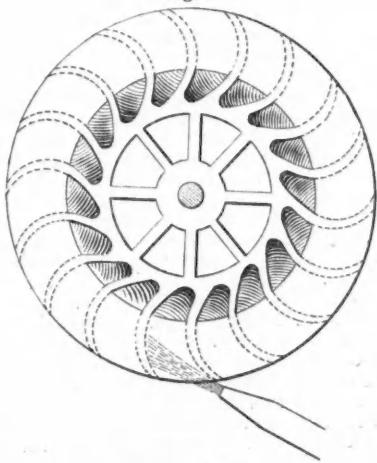


The Knight Wheel.

of machinery, this would indicate a duty on the wheel-shaft of fully 50 per cent.

Fig. 4 shows the next important improvement, being the Knight wheel, made of cast-iron, with curved buckets set close together. The nozzle is a narrow slit, curved to fit the outer edge of the wheel, the idea being to have the jet strike the buckets at as close a distance as is possible. With muddy water, the wear on this form of nozzle becomes objectionable; with considerable heads, a jet of circular section will probably show better results. This wheel has met with great favor, a large number of them being now in use. At the Providence gold quartz mill, near Nevada City, a Knight wheel did actual work amounting to about 54 per cent of the power of the water, in addition to overcoming friction of machinery. Mr. Browne found, in experimenting with curved buckets (section arc of circle), a maximum efficiency on the wheel-shaft

Fig. 5.



The Collins Wheel.

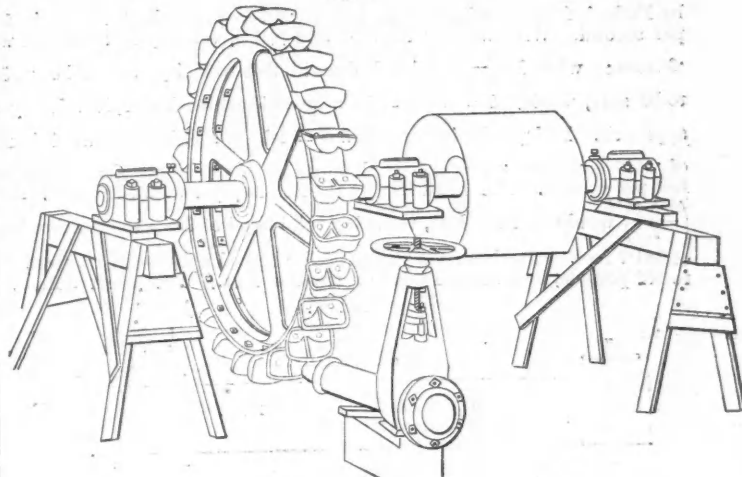
of 65.6 per cent, with a periphery speed of about 44 per cent of theoretical velocity of water. This was with a 3/8-inch tapered nozzle, and a head of 50.4 feet.

Fig. 5 shows the Collins wheel, which, when placed at the Providence

* This is doubtless due to the increased velocity of the vena-contracta at its smallest diameter, after the jet has escaped from the ring.

mill (before spoken of), as a substitute for the Knight, did the same work with 1/10th the amount of water. This mill has 40 stamps, each weighing 750 pounds, drop 8 inches, 92 drops per minute, aggregating work of lifting the stamps 1,840,000 minute foot-pounds. There are also one rock-breaker and sixteen Frue vanners (concentrators), requiring fully 8 horse-power (264,000 foot-pounds) more, making in all say 2,104,000 minute foot-pounds (64 horse-power). This work is done by a Collins wheel, 6 feet in diameter, running 250 turns a minute; the water is conducted to it through 1856 feet of wrought-iron pipe (1156 feet being 22 inches, and 700 feet 15 inches in diameter), and discharged under a head of 389 feet through a 1/4-inch nozzle. The water used amounts to very nearly 136 cubic feet per minute. Assuming 2 feet head as lost by friction in pipe, $387 \times 136 \times 62.4 = 3,284,237$ foot-pounds per minute; $2,104,000 \div 3,284,237 = 64$ per cent,* as useful effect in moving machinery. The wheel is quite a distance from the main line of shafting, the power being

Fig. 6.



The Pelton Wheel.

transmitted by belts. Allowing for losses of friction in belting, lines of shafting, cams, and stamps, there would result an efficiency on this wheel-shaft of over 70 per cent.

The latest, and probably the most efficient, bucket thus far discovered, is known as the Pelton wheel, a perspective view of which is shown by Fig. 6, and a section through the bucket by Fig. 7. The invention consists in splitting the jet as it strikes the bifurcation of the bucket; The

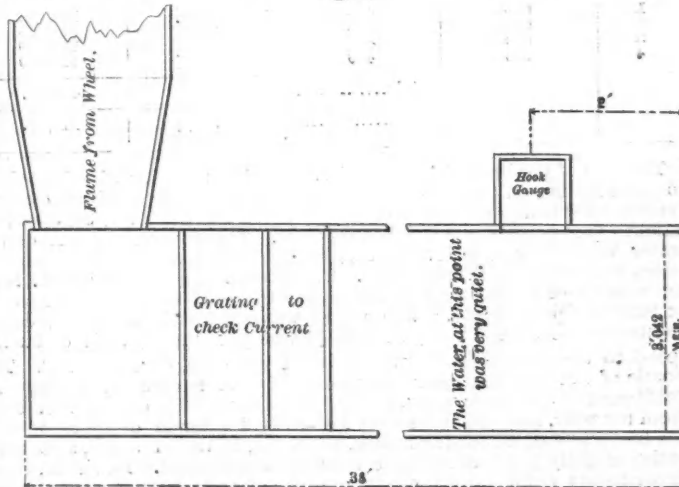
Fig. 7.

Section through Bucket.



line of the jet should be tangential to the wheel. Where much power is needed, two discharge-pipes can be used, and any desired form of nozzle applied. Mr. Browne found with one of these wheels, which was not built on the most approved model, the following results: Wheel, 15½ inches in diameter. Nozzle, 3/8ths inch, tapered. Head, 50.2 feet. Maximum efficiency on wheel shaft, 82½ per cent. Best speed of bucket, very nearly one half the velocity of the jet (substantially 1/2 (2gh) 1/2.) With the same nozzle, and a head of only 8 feet, he obtained a useful effect of 73 per cent. With a 1/4-inch nozzle, best result was 75.6 per cent; with a 3/8-inch nozzle, best result was 82.6 per cent. A number of tests of various hurdy-gurdies was made at Grass Valley some months since, under charge of disinterested parties. These experiments appear

Fig. 8.

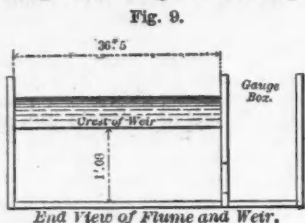


to have been properly made, with a Prony brake and weir measurement of water, and showed for the Pelton wheel, while doing 107.4 horse-power of work, under a head of 336 feet, the wonderfully high efficiency of 87.8 per cent.

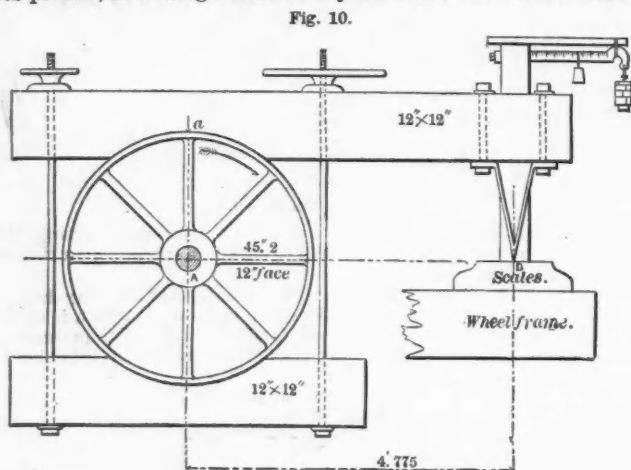
These experiments were made with a Pelton wheel 6 feet in diameter; nozzle, 1.89 inches in diameter; supply main, 6900 feet long, 22 inches in

* The writer determined amount of water used at this wheel by the flow through a standard aperture. The work done is only given with approximate correctness, but in all probability without serious error.

diameter, with a head of 386½ feet above nozzle. The water used was measured over an iron weir, ¼ inch thick, 3.042 feet long, without end contractions as shown in Fig. 8 and Fig. 9. The depth, as measured by a



Boyden hook-gauge, reading to .001 inch, was .4146 feet. The discharge by Fteley's formula of $Q = 3.81 l h^{3/2} + .007 l$, would be 2.709 cubic feet per second. With water section of 3.04×1.5 , velocity of approach was .6 foot; with $h a = \frac{V^2}{2g}$ head due to this velocity would be .0056; to be safe, $.0056 \times 2 = .0112 = h a =$ additional head due to velocity of approach. Fteley calls in general $h a = 1.5 \frac{V^2}{2g}$. This makes a total head of $.4146 + .0112 = .4258$; then with same formula as before, $Q = 2.819$ cubic feet per second. The head lost by friction in pipe, with formula $V = 50 \left(\frac{d h f}{l}\right)^{1/2}$ would be $1.8 = h f l$, reducing total head of 386.5 to effective head of 384.7 feet. (The Bourdon gauge used showed a pressure of from 165 to 163 pounds, indicating a head of say 380 feet.) The work done was



measured by a Prony brake, as shown by Fig. 10, bearing vertically down upon a platform scale, and which showed a weight of 200 pounds upon the scale-beam when the brake-gear was suspended by a cord from the point a, immediately above the wheel-shaft; this made a constant minus correction of 200 pounds. The friction-pulley had a face of 12 inches, was kept wet by a jet of clear cold water, did not heat much, and ran without much jumping.

There were thirteen tests made, showing pretty even results. The first four were as follows:

	a.	b.	c.	bc.
	Weight shown by scale.	Net weight (-200 lbs.)	Revolutions of wheel-shaft per minute.	
1	665	465	254½	118,342
2	665	465	255	118,575
3	660	460	256	117,760
4	660	460	256½	117,960
Totals.....			1022	472,667
Means.....			255½	118,167

The arm of the brake (A B) was 4.775 feet from center of wheel-shaft to point resting on the scale, and hence described a circle with a circumference of 30 feet. The work done was therefore $(118,167 \times 30) 3,545,000$ minute foot-pounds = 107.4 horse-power. The theoretic power of the water was $(2.819 \times 60 \times 384.7 \times 62.4) 4,060,253$ foot-pounds. Useful effect was therefore, 87.3 per cent. The effective head being 384.7 feet, the velocity of the escaping jet due to gravity would be 157 feet per second, or 9420 feet per minute. The wheel was six feet in diameter, hence circumference = 18.85 feet; with 255½ turns per minute, ratio of bucket speed to theoretic velocity would be 51 per cent, or $.51 (2 g h)^{1/2}$. The nozzle of 1.89 inch diameter had an area of .0195 square feet; hence its coefficient of discharge was .92. The hook-gauge was only 2 feet back from the weir, and doubtless gave a slightly too small depth of water; the coefficient of .92 for the nozzle, as above, is rather small, also indicating slightly greater discharge than that estimated. However, these experiments show in any event a duty of fully 85 per cent, which agrees with the results found by Mr. Browne.

The other competing wheels showed a much lower rate of duty. An inspection of a small Pelton wheel, running at a very high velocity, showed that it "carried over" a surprisingly small amount of water. This fact proves the excellence of this particular form of bucket.

The writer at first found it difficult to believe in such high percentages, but from the evidence before him is now satisfied that, with a wheel properly designed, and with heads above 100 feet, or even less, a larger

amount of work can be got out of water by the hurdy-gurdy than by any other form of wheel. Water-pressure engines* may possibly give as good or better results, but their great cost (due to the solidity with which their working parts and column must be built, to withstand the shock of arresting the moving water) will prevent them from coming into general use.

Where a wheel is so placed that it will at times be submerged by back water, the turbine is, of course, preferable to any other wheel. In other regards, however, the hurdy-gurdy possesses almost every advantage.

The chief misapprehension as to the hurdy-gurdy has been, in considering it simply as an impact, and not also as a pressure wheel, which, when properly designed, as Mr. Browne points out, it clearly is.

NOTE.—An examination of a hurdy-gurdy with either flat, recessed, or curved buckets, while at work, shows that the wheel "carries over" a

Fig. 11.

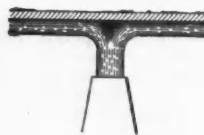


Fig. 12.



large amount of water, the force of which is consequently lost, and in fact becomes an additional load to lift.

Mr. Browne says: "When a jet of water strikes a stationary bucket, as shown in Fig. 11 or Fig. 12, so soon as the motion becomes permanent, the wedge-shaped portion of the water, shaded with horizontal lines, becomes practically stationary. When such a bucket is used for a wheel, it is plain that the shaded portion of the water is 'carried,' and must subsequently escape with nearly the full velocity of the bucket." The wedge that is inserted in the Pelton bucket takes the place of this "dead" water.

PROGRESS AT THE DOUGLAS MINE.

Special Correspondence of the Engineering and Mining Journal.

Only one mine, the Douglas, is working in this district. I visited the underground workings a few days ago, in company with the superintendent, Captain Daniel Dunn. The ore looks better than I ever saw it before, and a visit to the workings can not but convince any one that there is plenty of it there. A new engine is needed at the shaft-house. The one in use is not well adapted to running the pump that is attached to it, although it would do the hoisting for a long time to come, but it is situated too near the shaft to work to advantage. The Bradford concentrator is not in use, the ore being treated by leaching and precipitation. A large amount of precipitate is on hand, and a man is expected to come soon to run the refining-furnace. Of course, the present low price of copper is a serious matter for this company; but I believe that the difficulties will be overcome and the value of the mine as a producer and dividend-payer demonstrated to the satisfaction of even the most skeptical. I think about twenty men are now employed underground, and the necessary force of surface men to treat the ore.

My thanks are due to Captain Dunn for courtesies shown.

BLUE HILL, ME.

DIRIGO.

THE TEMPERATURE OF THE EARTH AS SHOWN BY DEEP MINES.

At a recent meeting of the American Society of Civil Engineers, observations on the temperature of the earth, as shown by deep mines, were presented by Messrs. Hamilton Smith, Jr., and Edward B. Dorsey. Mr. Smith said that the temperature of the earth varies very greatly at different localities and in different geological formations. There are decided exceptions to the general law that the temperature increased with the depth. At the New Almaden quicksilver mine, in California, at a depth of about 600 feet, the temperature was very high—some 115 degrees; but in the deepest part of the same mine, 1800 feet below the surface and 500 feet below sea-level, the temperature is very pleasant, probably less than 80 degrees. At the Eureka mines, in California, the air 1200 feet below the surface appears nearly as cool as 100 feet below the surface. The normal temperature of the earth at a depth of 50 or 60 feet is probably near the mean annual temperature of the air at the particular place. At the Comstock mines, some years since, the miners could remain but a few moments at a time, on account of the heat. Ice-water was given them as an experiment; it produced no ill effects, but the men worked to much better advantage; and since that time, ice-water is furnished in all these mines, and drank with apparently no bad results.

Mr. E. B. Dorsey said that the mines on the Comstock vein, Nevada, were exceptionally hot. At depths of from 1500 to 2000 feet, the thermometer placed in a freshly drilled hole will show 130 degrees. Very large bodies of water have run for years at 155 degrees, and smaller bodies at 170 degrees. The temperature of the air is kept down to 110 degrees by forcing in fresh air cooled over ice.

Captain Wheeler, U. S. Engineers, estimated the heat extracted annually from the Comstock by means of the water pumped out and cold air forced in, as equal to that generated by the combustion of 55,560 tons of anthracite coal, or 97,700 cords of wood. Observations were then given upon temperature at every 100 feet in the Forman shaft of the Overman mine, running from 53 degrees at a depth of 100 feet to 121.2 degrees at a depth of 2300 feet. The temperature increased:

- 100 to 1000 feet deep, increase 1 degree in 29 feet.
- 100 to 1800 feet deep, increase 1 degree in 30.5 feet.
- 100 to 2300 feet deep, increase 1 degree in 32.3 feet.

A table was presented giving the temperatures of a large number of

* The water-pressure pumping-engine, for some time in use at one of the shafts on the Comstock lode in Nevada, is said to show an efficiency of over 90 per cent. There are now three of these engines at work in the State of Nevada, and a paper fully describing them would be of much interest.

deep mines, tunnels, and artesian wells. The two coolest mines or tunnels are in limestone, namely, Chafarillo mines and Mont Ceniz tunnel; and the two hottest are in trachyte and the "coal measures," namely, the Comstock mines in trachyte and the South Balgray in the "coal measures." Mr. Dorsey considered that experience showed that limestone was the coolest formation.

RUSSELL'S IMPROVED PROCESS FOR THE LIXIVIATION OF SILVER ORES.—V.*
With Critical Remarks on other Methods of Copper, Silver, and Gold Extraction.

By O. A. Stetefeldt, New York City.

The Electrolytic Process.—In Europe, the tendency is, at present, very much in favor of the electrolytic process. The complete separation of the precious metals, and the great purity of the electrolytic copper, provided the process is conducted with the necessary precautions, are strong arguments in its favor. First successfully introduced in England, it has been in operation for several years on the continent, especially in Germany. The principal works there are those at Hamburg, Oker, and near Eisleben. The details of the process are everywhere guarded with the utmost secrecy, and admission to the works is generally refused. No literature of any value from a technical stand-point exists. Professor Hampe, of Clausthal, so well known to metallurgists through his researches on copper, after investigating the electrolytic process in a most thorough manner, had written an exhaustive treatise bearing on all practical questions. Its publication was officially suppressed. Such bureaucratic folly still exists in Prussia! If officers of the government are allowed to act in such a mysterious way—this takes us back to the times of the alchemists—we can not expect that a firm in Hamburg should be more liberal. This spirit of narrow-minded illiberality is fast gaining ground in the metallurgical works of Germany, and wherever the student goes, he is no more received with the cordial frankness of former times. Even the Ziervogel extraction-works of the Mansfeld Company are now closed to visitors, simply because the general manager was, at some time, refused admittance to silver extraction-works in Swansea. But are there, in fact, such awful secrets about the electrolytic process as this policy would indicate? And is it surrounded with such enormous technical difficulties as all the managers of European works seem to imply? My answer is in the negative. That these gentlemen have finally achieved a great success, after a long series of blunders, nobody will deny. But it seems to me they would have reached their goal much sooner, if they had paid a little more attention to well-established laws of electricity. That the working of copper matte, by this process, proved to be a failure might have been anticipated beforehand. The notion that any copper, no matter how impure, could be treated by it with economy might also have been condemned in advance. The electrolytic process permits the use of currents of low intensity only. With increased differences in the composition of the electrodes, the difference in their electric potential also increases, and a marked polarization of the current must be the result. But perhaps of still greater importance is the durability of the copper solution in which the electrodes are immersed. Certain impurities concentrate in this solution more and more, and are finally precipitated on the cathode. The peculiarity of arsenic to precipitate the sooner on the cathode, the lower the electric current is in intensity, was also known to physicists before it made itself felt in electrolytic works. That the process does not offer great technical difficulties, or require an experience of several years, has been demonstrated by its successful introduction at the metallurgical works of Mr. Balbach, Newark, New Jersey. The plant, of 800 pounds daily capacity, is by no means a model of construction, but it works well and with profit. Mr. Balbach claims no secrets, and admits with pleasure every body belonging to the profession.

There is no doubt that the electrolytic process offers many advantages compared with other processes, both in economy and perfection; but the large capital required for the plant and buildings, the extensive area covered by the latter, and the enormous quantities of metal in rotation are a bar to its introduction on a large scale. In this country, especially, capitalists are not inclined to invest so much money for such purposes. Hence it is a question whether it can compete with those processes which are based upon the regeneration of sulphuric acid, and require a comparatively inexpensive plant.

PROCESSES IN WHICH SULPHURIC ACID IS REGENERATED.

The Hunt and Douglas Process.—The Hunt and Douglas process has been described in the Transactions of the Institute, 1881. The matte is roasted, and the oxide of copper dissolved by dilute sulphuric acid in the presence of a soluble chloride. Gold, silver chloride, lead sulphate, and oxide of iron and antimony remain as insoluble residues. The copper is precipitated from the warm solution as cuprous chloride by sulphurous acid, and the sulphuric acid regenerated. In decomposing the cuprous chloride, after separating it from the acid solution, by iron, ferrous chloride is formed, to be used again for chloridizing the copper of subsequent charges.

In conducting the sulphurous acid through the copper solution, care must be taken to have the gas practically free from an excess of air. Otherwise, more sulphuric acid will be formed than cuprous chloride, the latter absorbing oxygen rapidly, and becoming reconverted to cupric chloride.

This process has, so far, not been introduced to work copper matte on a large scale, and nothing has been published about its technical difficulties or its economy. From a theoretical stand-point, it is very promising, especially for mattes containing antimony and arsenic. The cuprous chloride produced by this process is perfectly pure.

The Swansea Process.—Another process for treating copper matte, based upon the regeneration of sulphuric acid, is in operation at Vivian's works, Swansea. The roasted matte is dissolved in sulphuric acid, as is done at Freiberg, the gold and silver remaining in the insoluble residue. From the solution, copper is precipitated by sulphureted hydrogen, and the sulphuric acid regenerated. Sulphureted hydrogen is gained by passing sulphurous acid from a roasting-kiln, together with steam, through a column of hot coal. The gas ascends a tower through which

the copper solution is showered. Any loss in sulphuric acid is made good by copper sulphate contained in the roasted matte. The precipitate of copper sulphide is oxidized by a patented process—details not known to me—said to dispense with the use of fuel, and then reduced to copper in a reverberatory furnace. It is claimed that from very impure matte a copper of superior quality is obtained. This seems to me somewhat doubtful. To remove all arsenic from a copper matte by roasting is not possible. Arsenates formed in roasting are soluble in sulphuric acid. It is true, arsenic is precipitated from a solution by sulphureted hydrogen before copper. But a separation in this way seems to me practically difficult to accomplish.

This and the former process have very much in common in their manipulations. The principal difference consists in the final treatment of the copper precipitate. It would be premature to give a decided opinion as to which of them deserves preference.

EXPERIMENTS ON THE EXTRACTION OF GOLD FROM SILVER ORES THAT HAVE BEEN SUBJECTED TO A CHLORIDIZING-ROASTING.

a. Extraction of the Gold by Lixiviation with Hyposulphite Solutions.—Considering the comparatively low percentage of gold extracted by amalgamation, it was of practical importance to ascertain, in the first place, if Russell's process would yield a larger amount of gold, and if it could enter successfully into competition with amalgamation also in this respect.

We find it stated in treatises on metallurgy that calcium hyposulphite is a more energetic solvent for gold than the sodium salt, and in copying this statement, metallurgical writers have gone so far as to assert that sodium hyposulphite does not extract any gold at all. Prof. T. Egleston in his paper, "Leaching of Gold and Silver Ores in the West," Transactions of the Institute, 1883, says: "The use of hyposulphite of calcium has a great advantage in the treatment of ores containing even a very small quantity of gold, as it dissolves nearly the whole of the gold, and allows of its being extracted, while the hyposulphite of soda does not." That there is no possibility of misunderstanding this sentence, becomes evident in quoting another passage from the same paper. "The leaching process is also applicable to ores containing both gold and silver; for when hyposulphite of soda is used, after the ores have been leached for silver, the tails can be treated by Plattner's process, and the gold and silver both recovered in a state of high bullion, so that a parting process would not be necessary, and when hyposulphite of lime is used, they are recovered together." Professor Egleston's authority for this statement is not given. Nor does it seem to me that there is any scientific foundation for it, the double salt of $3Na_2S_2O_3 + Au_2S_2O_3 + 4aq$, being as easily soluble as the calcium double salt. To settle this question, I induced Mr. Russell to carry out some comparative experiments with ore from the Lexington, Montana, and from the Custer, Idaho. For the sake of completeness, Mr. Russell also used solutions of potassium and magnesium hyposulphites. In all cases, the solutions were of 2 per cent concentration, and the figures below represent the averages of six tests:

Sample from	Ounces gold remaining in tailings after lixiviating with the hyposulphite of			
	Sodium.	Potassium.	Calcium.	Magnesium.
Lexington mill.....	0.333	0.316	0.326
Lexington mill.....	0.308	0.320	0.313
Custer mill.....	0.280	0.350	0.362

These figures prove conclusively that the superiority of a calcium hyposulphite solution for the extraction of gold from roasted silver ores is a fable.

As far as the percentage of gold is concerned, which is extracted by lixiviation with hyposulphite solutions, Mr. Russell made a great number of tests with ore from the Lexington mill. The results varied between 60 and 70 per cent of the gold extracted. The statistics of the Lexington mill show that by amalgamation the yield is only from 53.5 to 63.1 per cent. Hence, lixiviation is also in this respect superior to amalgamation. Mr. Clark worked ore from the Alice mine, Montana, at the Bertrand mill, and reports a larger yield in gold than that obtained by amalgamation at the Alice mill.

In lixiviating Custer ore, the results were less favorable, compared with amalgamation. I have no doubt, however, that in this instance also superior results may be obtained by modifying the treatment of the ore in roasting.

b. Extraction of Gold by the Sulphides of the Alkaline Metals, and by Extra-Solution.—The solubility of gold sulphide in extra-solution, and the fact that it is also dissolved by the sulphides of the alkaline metals, led to experiments in extracting gold by these reagents. My idea was to treat the residues of gold-bearing silver ores, after the extraction of the silver and a part of the gold, by Russell's process, with sodium sulphide solution (or with CaS_2), and convert the gold into a sulphide, and then react upon it with extra-solution. A part of the gold would be dissolved by sodium sulphide, and another part by sodium hyposulphite.

Mr. Russell's first object was to ascertain the solubility of metallic gold in a sodium sulphide solution. For this purpose, he utilized the solution prepared for the precipitation of silver in his lixiviation process. It contains about 24 per cent of sodium polysulphide, and also sodium hyposulphite, resulting from its preparation by boiling caustic soda with sulphur. In carrying out the experiments, 25 milligrams of pure gold-leaf were left in contact with solutions of different concentration for three and a half hours on the sand-bath, and the gold dissolved was determined.

25 milligr. gold-leaf, and 50 c.c. sodium polysulphide solution.	Water added. c.c.	The solution contains in sodium polysulphide. Per cent.	Gold dissolved, milligr.
1.....	10	20	19.8
2.....	25	16	17.2
3.....	50	12	6.0
4.....	75	9½	2.6
5.....	100	8	1.0

The more dilute solutions dissolved only fractions of a milligram of gold. In experiments 1 and 2, the solutions had become very much concentrated by evaporation on the sand-bath. The whole series shows that the solvent energy of the solution is principally a function of concentration.

In treating, by the method indicated above, samples of roasted ore from the Lexington mill, which contained 0.8 ounce gold per ton, Mr. Russell succeeded in producing tailings with only from 0.09 to 0.05

*See the Cincinnati Meeting of the American Institute of Mining Engineers.

ounce gold per ton. This sample had an unusually low chlorination of the silver, and in repeating the experiment with ore of normal chlorination the results were less favorable, but still much better than by amalgamation. A sample of roasted copper matte from Argo was also tested by this process. It contained 5.4 ounces gold per ton. Of this, 3.65 ounces were extracted, namely, 2.55 ounces by sodium sulphide, and 1.1 ounces by extra-solution. Further experiments established the fact that the sodium sulphide solution has to be rather concentrated, and must be used warm to be effective. For this reason, and on account of the difficulty of separating the gold from the sodium sulphide solution, I do not consider this method of practical value, and it has not received further attention. The idea of extracting gold by a solution of an alkaline polysulphide is not claimed to be new.

IV. WORKING ON A LARGE SCALE.

Mr. Russell has not been content with mere laboratory experiments, but has tested his process on a large scale. The experimental plant at the Ontario mill is capable of lixiviating a charge of 3 tons in one tank. More than 100 charges of Ontario ore have been worked up to date. In these experiments, the following facts have been ascertained:

§ 23. Preliminary Leaching with Water.

It is just as effective and more judicious to leach the roasted ore with cold and not with hot water, prior to turning on the hyposulphite solution. Hot water will dissolve a larger percentage of AgCl, this being more soluble in hot than in cold brine. The first wash-water, which contains copper and some silver, is conducted to tanks filled with scrap-iron, where the copper, and with it most of the silver, is precipitated. Mr. Russell has determined in ten charges (of two tons each) the total amount of silver dissolved by the wash-water, and the amount recovered with cement-copper:

Total amount of silver dissolved per ton.....	0.39 ounces.
Amount of silver recovered with copper.....	0.28 "
Amount of silver lost.....	0.11 "

These figures will, no doubt, vary in other localities, where more or less salt remains undecomposed in the roasted ore, and acts as the principal solvent for the chloride of silver.

§ 24. The Extra-Solution.

After leaching with water, the AgCl in the charge is first extracted with an ordinary hyposulphite solution, containing from 1½ to 1¾ per cent of the commercial Na₂S₂O₃ + 5aq. This solution is made slightly acid with sulphuric acid, so as to neutralize any caustic soda it may contain. After most of the silver chloride is dissolved, the extra-solution is turned on, to act upon the silver not present as chloride. This method of lixiviating has the best effect. Mr. Russell found that the extra-solution is a much poorer solvent for silver chloride than ordinary hyposulphite solution. The solubility of silver chloride rapidly decreases with an increase of copper sulphate added to the solution. That this should be the case follows from the reactions taking place in the formation of cuprous hyposulphite.

The extra-solution is made up by adding to a measured quantity of ordinary solution so much copper sulphate dissolved in the smallest quantity of water that a standard extra-solution is formed. By allowing the extra-solution to sink through the charge, and pumping it up again, all particles of ore are brought in contact with it.

The peculiarity of the extra-solution, if prepared as indicated above, to part with a precipitate of a cuprous hyposulphite double salt after some time, makes it desirable to obtain this solution in a more permanent form. This can be done by dissolving 18 parts of sodium hyposulphite and 10 parts of copper sulphate, each in a small quantity of water, mixing the solutions, allowing the precipitate of 2Na₂S₂O₃·3Cu₂S₂O₃ + 5aq. to separate completely, decanting the clear solution of sodium sulphate and tetrathionate, and redissolving the precipitate, after washing it, in a pure sodium hyposulphite solution of from 1 per cent to ¼ per cent concentration. This extra-solution of constant strength is used for several ore-charges in succession, until the cuprous hyposulphite is nearly exhausted, before it is turned into the precipitating-tanks. Here the silver is best precipitated by sodium sulphide from which any sodium sulphate that this reagent may contain has been removed by calcium sulphide. (As to reaction here taking place, I refer to § 26.) The pure regenerated solution of sodium hyposulphite is then utilized again for dissolving a fresh charge of 2Na₂S₂O₃·3Cu₂S₂O₃ + 5aq. By this method a much better effect from the same quantity of copper sulphate is obtained than by the one first described.

It will be seen in § 23 that, in working on a large scale, a larger percentage of silver is extracted than is shown to be soluble by laboratory tests. This is undoubtedly due to the prolonged time of the reaction, and to the use of ordinary and extra-solution in succession.

§ 25. The Precipitation of PbCO₃.

An extra series of tanks has to be provided for the precipitation of the lead. The soda-ash solution is purified as stated in § 11. The PbCO₃ settles in less than one hour, leaving a perfectly clear solution to be decanted into the silver precipitating-tanks. Whenever the precipitate has accumulated in sufficient quantity, it is collected by means of a filter-press. The value of the lead carbonate will, in many localities, pay for the soda-ash used in precipitating it. Besides, we should consider that the lead would otherwise have to be precipitated as sulphide by sodium sulphide. As this reagent is more costly than soda-ash, whatever is realized for the lead is clear profit. The great advantage, however, is the absence of lead in the sulphides of silver and copper precipitated from the lixiviation solution.

§ 26. The Precipitation of Ag₂S and CuS.

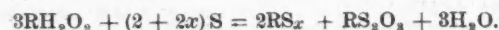
In Russell's process, silver and copper have to be precipitated from the hyposulphite solution by a sodium sulphide. Calcium sulphide can not be used, because any lime entering the lixiviation solution would be precipitated with lead as carbonate in effecting the separation of the lead, as shown in § 25. Calcium sulphide having been generally introduced into lixiviation-works as a precipitant for silver, it might be argued that the necessity of abandoning this practice is a point not in favor of Russell's process for separating lead. Hence, it is a question of

importance, to which hitherto metallurgists have paid little attention, to examine carefully if there are any tenable reasons for this preference, or if the practice is merely based upon a prejudice. In fact, the issue is a double one: 1st. Is calcium sulphide preferable as a precipitant for silver? 2d. Is a calcium hyposulphite lixiviation solution superior to one of the sodium salt? The continual use of calcium sulphide gradually converts the original sodium hyposulphite solution into one of calcium hyposulphite.

In considering the first question, the following points are involved: A. The preparation of the sulphide solutions and their composition; B. Their action and value as precipitants.

A. Preparation of Calcium and Sodium Sulphide Solutions, and their Composition.—In preparing calcium sulphide, caustic lime is boiled in water with an excess of sulphur, so that the polysulphides CaS₄ and CaS₅ are formed. This excess of sulphur is necessary, because the lower calcium sulphides are not easily soluble in water, and this solution must be used rather concentrated. From the slight solubility of calcium hydrate in water, it follows that this process must require considerable time. Sodium hydrate, on the contrary, is very easily soluble in water, and the sodium monosulphide and all of the polysulphides being equally so, the process must be completed very rapidly. In preparing, for instance, both solutions with the same amount of sulphur, and under otherwise equal conditions, the sodium solution precipitated, after six hours' boiling, seven and one half times as much silver as the calcium solution. Continuing the boiling for seventy-two hours, the calcium solution had reached its maximum of precipitating energy, but precipitated only 0.76 as much silver as the sodium solution after six hours' boiling. This demonstrates the wastefulness of the calcium process in sulphur and time.

Another question, however, is of equal if not of greater importance. The reactions taking place in boiling a caustic alkali with sulphur are expressed by the formula:



That is to say: For two equivalents of the alkaline sulphide, one equivalent of a hyposulphite salt is formed. Now, let us consider the peculiarities of solutions at boiling-point, containing calcium or sodium hyposulphite. A solution of sodium hyposulphite can be heated to 100 degrees C. without much injury—it decomposes very slowly. A solution of calcium hyposulphite, on the contrary, decomposes rapidly into gypsum and sulphur if heated above 60 degrees C. From this, it follows that in preparing the calcium solution most of the calcium hyposulphite formed is again decomposed, and that in its place calcium sulphate is obtained. In order to test the correctness of this reasoning, Mr. Russell determined the quantity of calcium hyposulphite formed in the preparation of calcium sulphide. The only feasible method was the following: To the solution of calcium sulphide freshly precipitated silver chloride was gradually added, until the former was completely decomposed and the silver chloride ceased to be discolored. Then more silver chloride was added, and the solution left for twenty-four hours. Its filtrate, upon being tested with sodium sulphide, showed a very small quantity only, and in some cases no silver at all dissolved, depending on the time of boiling in preparing the calcium sulphide solution. A large quantity of calcium sulphate, however, was found in the residue of the original solution. It will be seen that here again a portion of the sulphur is completely wasted, which, with sodium sulphide, appears as hyposulphite. The calcium sulphide solution can only contain the hyposulphite salt after it has been exposed to the oxidizing influence of the air.

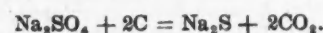
It is evident that, in the lixiviation process, a certain quantity of hyposulphite must be lost, namely in the wash-water, which has to be precipitated by itself, and is too dilute to be mixed with the normal solution, and also by decomposition in contact with the atmosphere. This loss has to be made good, otherwise the solution would get weaker, and finally refuse to dissolve any silver. If a sodium sulphide solution, to be used for precipitating the silver, has been prepared as stated above, it contains a considerable quantity of sodium hyposulphite. For each part of silver precipitated, 0.574 parts Na₂S₂O₃ + 5aq., and for each part of copper, 1.968 parts Na₂S₂O₃ + 5aq. are added to the lixiviation solution. Hence, in working high-grade ores, and especially if much copper is present, the lixiviation solution actually becomes more concentrated with continued use. The same reasoning does not hold good if freshly prepared calcium sulphide is used as the precipitant, according to what is stated below.

That a solution of calcium sulphide oxidizes rapidly at ordinary temperature, with formation of hyposulphite, is established by practical experience. Mr. Ottokar Hofmann, who used calcium sulphide as precipitant, at the Silver King mill, Arizona, states to me that the original sodium hyposulphite solution was used over a year and a half, and that it increased in strength and volume, making it necessary to run a part of it to waste. In this case, a large amount of copper and lead was precipitated with the silver.

At La Dura, Sonora, Mexico, the lixiviation solution was allowed to flow into the river by the stupidity of a laborer. A new supply of sodium hyposulphite could not have been obtained in less than ninety days, and in this dilemma, Mr. Hofmann proceeded to manufacture a new solution from the calcium hyposulphite contained in the sulphide. The lixiviation wash-water containing the base metals was precipitated with calcium sulphide, and the operation repeated until a calcium hyposulphite solution of sufficient strength had been obtained to resume operations. I am sure this process would not have been successful with freshly prepared calcium sulphide, and that sodium sulphide would have answered the purpose much better.

While these facts show that a calcium sulphide solution, unless freshly prepared, is by no means deficient in hyposulphite, they do not contradict any of the arguments offered in favor of the sodium sulphide. Sodium sulphide, proving to be superior in many respects, can be economically prepared by several methods, namely:

1st. By reducing sodium sulphate at a high temperature, with carbon:



The disadvantages of this method are, that the solution contains no hyposulphite, and that Na₂S, in contact with air, changes to hyposulphite.

with formation of caustic soda. The latter finally absorbs carbonic acid, and changes to a carbonate:



In order to utilize such a solution in the lixiviation process, it would be desirable to boil it with sulphur, and then expose it to the air. The oxidation of a solution of Na_2S_2 produces $\text{Na}_2\text{S}_2\text{O}_8$ only, while the higher polysulphides decompose in the same manner, but with precipitation of free sulphur.

2d. By melting sodium carbonate with sulphur.

Carbonic acid is liberated, and sodium polysulphides and hyposulphite are formed. If the temperature is raised too high, the hyposulphite is changed to sulphate.

3d. By boiling a solution of caustic soda with sulphur.

The reactions which take place in this case are expressed by the general formula introduced previously.

(TO BE CONTINUED.)

FURNACE, MILL, AND FACTORY.

Creveling, Miles & Co. have fired their Danville, Pa., furnace, which has for some time been undergoing repairs. They will also soon blow in Chulasky furnace, near Danville, which they have been repairing.

The puddle mill of the Glasgow Iron Company, at Pottstown, Pa., after frequent and long stoppages, has resumed operations.

Thirty two furnaces have started up at the iron-works at Kittanning, Pa.

Messrs. Parke, Lacy & Co., of Salt Lake, Utah, have shipped to the Bullion Mining Company, at Bullion, Idaho, a forty horse-power steam-boiler, an air-compressor, an air-tank, Ingersoll air-drills, a hoisting-engine, etc.

The report of Fayette Brown, receiver of Brown, Bonnell & Co., Youngstown, Ohio, for April shows that the balance on hand April 1st was \$14,926.84, and the receipts during the month \$170,472.41, making a total of \$185,399.25. The disbursements for April were \$164,880.45, and the balance on hand May 1st, \$20,518.80.

The Lagrange Iron Company is building a new furnace at Lagrange, Tenn., that is to take the place of the old one. The stack will be 65 feet high and the bosh 12 feet in diameter. The furnace will be put in operation some time in June.

It is stated that the Clifton Iron Company, at Clifton, Tenn., has begun work on its No. 2 furnace, and hopes to put it in blast in September next. The company has one furnace in operation, using charcoal.

The Western Union Wire Fence Company, the Missouri Wire Fence Company, and the St. Louis Wire Fence Company have been merged into one company, under the name of the Western Union Wire Company. The new concern has a paid-up capital stock of \$100,000. The new company is licensed by the Washburn & Moen Manufacturing Company for a maximum production of 10,000 tons of wire yearly, and it is its intention to manufacture to the extent of the limit. The works are established in the buildings previously occupied by the Western Union Wire Fence and Missouri Wire Fence companies.

The puddling department of Chess, Cook & Co.'s mill, at Pittsburg, Pa., shut down May 22d, throwing a large number of men out of work. The firm gives as a reason for the shut-down a lack of orders, but hopes to start up again before long.

The Union Iron and Steel Company has been reorganized, the new company being called the Union Steel Company.

The nail factory of the Hollidaysburg Iron and Nail Company, Pennsylvania, was destroyed by fire May 25th. Loss \$10,000.

The officers of the Columbus & Hocking Valley Coal and Iron Company have completed arrangements for starting their furnaces in the Hocking Valley. The furnaces at Gore and Crafts will therefore probably start about June 15th, if not sooner.

Lookout mill, at Chattanooga, Tenn., has shut down, and will not start with present owners.

The Cambridge Iron Roofing Company has recently completed a large addition to its factory, in order to meet the wants of its growing trade. It has also recently placed a new corrugating machine in its factory.

The Stillwell & Bierce Manufacturing Company, Dayton, reports the demand for its feed-water heater and purifiers and mill machinery as excellent. It employs a full complement of hands.

The Glendower Iron Company of Danville, Pa., has become financially embarrassed, and an execution has been issued to the sheriff on a judgment for \$50,000. Several suits have been brought against the company by banks which hold the company's notes. The company had a capital of \$110,000, and holds real estate nominally valued at \$200,000, which is mortgaged for \$175,000. The liabilities are estimated at from \$150,000 to \$200,000.

At the instance of the Molsons Bank, the Ontario Rolling-Mills, and Ozias Shipman, the goods and plant of the London Steel-Works, Ontario, Canada, have been seized by the sheriff and are offered for sale on June 3d. The claims of the above parties amount to about \$4000, and the plant seized is said to be worth \$40,000 or \$50,000. An application has been made for the winding up of the company.

The application of James and Frank Pierce, of Sharpville, Pa., to the Erie courts, for a receiver of the Mount Hickory Iron Company has been refused.

The new double engine hoist for the Inez Gold Mining Company of California, purchased from Rankin, Brayton & Co., San Francisco, has been shipped and will soon be ready for active work. It will sink to 1200 feet. This company will now do some active prospecting, and when sufficiently advanced will erect a 10 or 20 stamp mill. Rankin, Brayton & Co. are also erecting a new 60-ton copper plant for the New Jersey & Sonora Reduction Company, at Nacasarí Cañon. It will blow in on or about the 29th inst., and will mark a new era in that portion of Mexico. The company's mines are very extensive and contain large bodies of 20 per cent ore. It is claimed that this concern will deliver its production in Liverpool at a cost not to exceed 7 cents a pound.

The Cambria Iron Company has received an order from the Cincinnati, New Orleans & Texas Railroad for 15,000 tons of 60-pound rails.

An order in council has been issued at Ottawa, Canada, allowing a drawback on exports of cut nails manufactured in Canada, not finer than small thirds, of 90 per cent of the duty paid on iron imported to make them. When trouble arises in establishing the value, a specific duty of 16 cents per 100 pounds will be allowed on bar iron, nail strips, or steel, or 8 cents on puddled bars used with scrap or other duty-free material, the latter not to exceed 25 per cent of the quantity.

RAILROAD NEWS.

The secretary of the Denver & Rio Grande Railroad has stated that the company is working very amicably with the Colorado Coal and Iron Company, and the relations with the Rio Grande Western are unchanged from last reports.

Articles of merger have been filed at Harrisburg, Pa., in the office of the Secretary of the Commonwealth, consolidating the Moshannon & Clearfield Railroad and the Tyrone & Clearfield Railroad under the corporate name of the latter company. The capital stock of the new company is \$1,500,000.

A decision was rendered, May 23d, in the Circuit Court, at Birmingham, Ala.,

by Judge Spratt, giving the Alabama Great Southern Railroad Company possession of nearly 6000 acres of coal and iron lands, sold by J. C. Stanton, while president of the road, when it was known as the Alabama & Chattanooga. The complainants denied the authority of Stanton to sell the lands, and the defendants had no evidence to prove such authority.

The statement of the business of the Philadelphia & Reading Railroad Company for April, shows the gross earnings to have been \$4,093,752; expenses, \$2,682,801; net earnings, \$1,410,951; an increase of more than \$800,000 over the net earnings of March, and nearly \$600,000 more than for April, 1883. Net earnings for the year to date, \$4,008,586, against \$3,658,672 for the corresponding period of last year. The statement for April includes the operations of the New Jersey Central, as follows: Gross receipts, \$971,886; working expenses, \$505,260; net earnings, \$466,626; rental, \$514,643; loss for the month \$48,017; against a deficit of \$272,311 for March, \$180,681 for February, and \$292,074 for January.

Engineers are surveying for a railroad from Coalport, Clearfield County, Pa., to Cresson, Cambria County, Pa., which, it is said, will open up the largest bituminous coal-field in the State.

At a meeting of the Board of Railroad and Warehouse Commissioners, at Springfield, Ill., it was decided to make no change in the maximum rates for coal transportation as now fixed by the board.

The Delaware & Hudson Canal Company announces an increase of capital stock, from \$20,000,000 to \$30,000,000.

LABOR AND WAGES.

In the Court of Common Pleas, at Pittsburg, May 24th, Judge Stowe granted the iron manufacturerers a license for the creation of a voluntary tribunal to adjust the disputes between the employers and the employés in the iron rolling-mill trade, upon the condition that the assent and agreement of the necessary number of the employés be obtained.

The Senate has passed the bill for the establishment of a Bureau of Labor Statistics. It provides for the appointment of a Commissioner of Labor, to serve for four years, at a salary of \$3000 a year. He is charged with the collection of information regarding labor, its relation to capital, the hours of labor, the earnings of laboring men and women, etc. The total expenses of the bureau are not to exceed \$25,000 a year.

It has been arranged so that all the Reading Railroad Company's employés in the machine and blacksmith-shops, boiler-works, and foundry at Reading will hereafter work eight hours a day, instead of ten, and that the foremen will work "half-shift," each set of men being employed every other week.

A dispatch from Pittsburg, May 28th, says: Fifteen hundred coal miners in the third pool have refused to accept a reduction of a quarter of a cent, and will strike unless the district price is paid. A delegate meeting is to be held in Monongahela City, to consider the advisability of ordering a general strike of the four pools.

The coal miners in Western Indiana have been on a strike nearly three months, the cause being a reduction in the price of mining to 75 cents a ton. A meeting of the miners was held at Brazil, and it was resolved by a small majority to accept the terms of the officers. It is supposed that work will be resumed immediately.

Forty Italian laborers have been brought to Hastings, Iowa, to work in the Gumbo coal mines. The men already employed, who number nearly two hundred, are indignant, and refuse to let them go to work. A difference in wages causes the trouble.

President Keim, of the Philadelphia & Reading Railroad Company, states that a small amount of wages scrip was issued May 28th, and that it was willingly received by the employés. He further states that he hears of no objections to taking it.

COAL TRADE NOTES.

COLORADO.

Mr. McNeil, State Inspector of coal mines, has inspected the Boulder Valley mine, owned by the Union Pacific Company, at Erie. He found the mine in a bad condition, and considers it unsafe for the men to work in it. About two months ago, says the Denver *Republican*, the inspector gave the company notice of the necessity of putting the mine in a safe condition, and it promised to do so, but thus far has failed to comply with the demand. This mine is an extensive one, shipping about three hundred tons per day. It needs an air-shaft and a ventilating fan. The air-courses are in bad condition and are liable to cave on the workmen. The inspector warned them of this danger, and under the circumstances recommended that they cease work.

ILLINOIS.

The Lincoln Coal Mining Company, at Pana, has struck an eight-foot vein of good coal in its shaft, at 415 feet from the surface. The shaft will soon be in operation hoisting coal for market.

MARYLAND.

Mine Inspector Sheridan is now making his first tour through the mining region. He started May 10th at Franklin, and is now engaged in visiting the mines at Lonaconing.

MISSOURI.

Several capitalists have purchased a very valuable tract of coal land in the vicinity of Carbon Center, Vernon County. Prospecting has been prosecuted sufficiently to develop a very fine vein of coal and of equal thickness with the veins in the Rich Hill coal belt.

NEVADA.

A company is prospecting for coal at Verdi, Washoe County. Contracts have been made with land-owners thereabouts for the privilege of their lands. The company proposes to sink a diamond drill far enough to thoroughly prospect the place. It is prepared to sink 1500 feet.

NEW YORK.

At a meeting of the Consumers' Coal Company, held in this city recently, the following gentlemen were elected trustees for the ensuing year: C. Stewart Schenck, I. P. Stephens, Henry Dexter, Paul Coster, Thomas Darling, H. C. Dart, E. C. Evans, Henry Mote, E. R. Almy, J. A. Hibson, J. H. Keeland, J. A. Cutter, C. A. Manning. At a subsequent meeting of the board, Mr. C. Stewart Schenck was unanimously re-elected President; I. P. Stephens, Vice-President.

OHIO.

An arrangement has recently been made between the Tuscarawas Coal Company and the mines tributary to the Cleveland, Lorain & Wheeling Railroad in Ohio, whereby, in future, all orders for coal will be filled by the former. The mines included in this arrangement are, the Pittsburg & Wheeling Coal Company, Tuscarawas Valley Coal Company, Brock Hill Coal Company, Flushing Coal Company, and Goshen Coal Company. The combined mining capacity of these mines is 4000 tons daily. At present, they are running at one half their capacity.

At Chapman, work continues about the same as it has been of late. Willow No. 5 is getting ready to start at last. It is estimated that it will be worked out in a year. The Youngstown Coal Company is about to have a switch put into its mines from the Pittsburg, Fort Wayne & Chicago Railroad. This company intends to run about fifty miners in the near future.

PENNSYLVANIA.

ANTHRACITE.

The Skidmore vein, struck last February at the Monitor colliery, proves to be worthless.

Work is to be resumed in the Black Ridge collieries at Conyngham station, which have been drowned out and abandoned since the spring of 1883. A slope is to be sunk to the Buck Mountain vein, about two hundred feet from the breaker, and other important improvements are at once to be made. The mines are operated by Wentz, Leisenring & Dodson.

The new air-shaft at the Avondale colliery, which is controlled by the Delaware, Lackawanna & Western Coal Company, is to be put down to a total depth of two hundred and fifty feet.

The tunnel at Eagle Hill colliery has cut a vein of coal 10 feet four inches thick. It is supposed to be the "Seven-Foot."

The Locust Mountain Water-Works, which are to supply the Lehigh Valley Coal Company's collieries, will cost \$225,000.

It is reported that Mine Hill Gap colliery will be abandoned on account of the dirt-bank fire. This will throw 300 men and boys out of work.

The first shipments from North Lincoln colliery were made May 21st. Work will be suspended for an indefinite period at the Pottsville shaft, Bast colliery, at Ashland, and Preston colliery, No. 2, at Girardville. These three collieries have been among the least productive and yet most expensive on the Philadelphia & Reading Coal and Iron Company's long list, and during the present financial crisis it has been deemed best to practically abandon them.

BITUMINOUS.

Colonel J. M. Schoonmaker has purchased Albert Newcomer's farm, in Tyrone township, for \$8000. The coal had long since been purchased by Colonel Schoonmaker; but when he came to work it, he found himself unable to do so with any safety to the surface, hence he bought the surface, to avoid any litigation or possible question of damages.

Blythe & Co. have leased the McClure tract of coal, at Douglass Station, embracing 400 acres, and will be taking out coal in a few months from now. The pit-mouth has been located, and will be opened at an early day. Entries will have to be driven, however, the tipples erected, the side-tracks graded, and iron laid before the shipment of coal will be commenced, which will take two or three months, at least.

At Myersdale, the Cochrane mine is idle. Keystone mine is shut down. Williams mine is running about half-time. Flog Hill mine is loading two gondolas a day. Hocking mine is working to the capacity of four hoppers a day.

The mines of McConnell & Co., at Du Bois, are idle, owing to the miners being out on strike against a screen system that the coal operators are trying to impose upon them. The latter want them to mine coal for 60 cents a ton over the screen, and the miners refuse to accept the offer. The Sandy Lick mines are idle. The Rochester mines are on half-time. Every thing is dull.

COKE.

The Connellsville Coke and Iron Company is using every precaution to avoid future accidents at its mine. It has now in place at each of its two shafts at East and West Leisenring one of the largest fans in the western part of the State. They are twenty feet in diameter and have six-foot paddles.

The Coke Producers' Association met May 30th, at the office of President Boyle, in Pittsburg. It was the first pay day of the syndicate, and checks were given to the various producers for over \$150,000. All the members were present, and it was unanimously agreed to continue. President Boyle declares the association to be a fixed thing. He said further that since the formation the value of coke property has increased in the Connellsville region from 20 to 25 per cent, and the works are now running at a small profit. Every thing is uniform, the trade is equally divided, and wages are alike all through the region.

The shipments of raw coal from the Percy mines for May, to the Gainsford coke-works at Cincinnati, will amount to about 3000 tons. An air-furnace that draws out all the impure air has been put up at the mines.

J. W. Rainey & Co. are building 24 new ovens at the Moyer works. It is the intention of the company to build one hundred and fifty more this summer.

GENERAL MINING NEWS.

ARIZONA.

COCHISE COUNTY—TOMBSTONE DISTRICT.

Local papers report that the latest phase of the conflict between mine-owners and miners is, that the mines will not pay more than \$3 a day and will not employ union men, even at that rate. Union men are leaving camp rapidly.

GRAND CENTRAL.—At a directors' meeting, it was decided not to resume work on the mine except on the basis of \$3 a day.

GILA COUNTY.

OLD DOMINION.—The judgment recently filed by C. E. Brooks, for \$6692, has been satisfied.

GRAHAM COUNTY.

DETROIT COPPER COMPANY.—The different mines of this consolidation are looking well, more particularly the Yankee and Montezuma. On this latter mine, a prospect-shaft has been sinking in which ore of an excellent character has been struck. It is said to mill 40 per cent. The same ore-body is worked on another portion of the claim.

PIMA COUNTY.

TUCSON CANNON-BALL MILLING AND REDUCTION COMPANY.—This corporation has been organized by gentlemen in Tucson, for the purpose of erecting and running milling and reduction-works in that city. The company proposes at first to use the Dyer Cannon-Ball mills, but, if business demands, other mills and also smelters will be used. The erection of the works has begun. The capital of the corporation is \$10,000.

PIMA COUNTY—QUIJOTOA DISTRICT.

W. H. Patton, manager for the bonanza firm at the Quijotoa mines, states that extensive work will begin at once. It is the intention to put up a 20-stamp mill near the well half a mile east of the town-site of New Virginia, and, as soon as other wells are completed, the capacity of the mill will be increased to forty stamps. It is understood that some new developments have been made in the tunnels on the east side of the mountain, and that the working force is to be increased at once. Two new winzes are to be sunk at once, and drifting will be commenced in the tunnels.

CALIFORNIA.

INYO COUNTY—WILD ROSE DISTRICT.

This district lies about 23 miles east of Lookout, in the southern end of the county. About seven years ago, the Argonaut, Juniata, Blue Belle, Blizzard, and Virgin mines were located. Thousands of dollars and years of hard labor have been spent in developing these properties. The Juniata has a six-foot ledge that gives an average assay of \$50 per ton. There are 100 tons of assorted ore now on the dump that will yield \$100 per ton. The Argonaut joins the Juniata on the south, and has a ledge of equal size and richness. The Blue Belle is situated about six miles distant from the former mines. It has a well-defined 30-foot ledge, and it is claimed the ore will average \$80 per ton. There are on the Blue Belle dump over 100 tons of this character of ore. The Blizzard and Virgin are close to the Blue Belle. The former claim has a four-foot ledge of fine horn-silver ore. There is plenty of wood and water close at hand, and the mines are

easily reached by good roads from Panamint and Death Valley. At present, enough ore has been developed to keep a 10-stamp mill constantly at work for many years.

MONO COUNTY.

MAY LUNDY.—Work has been resumed. Five additional stamps for the mill are on the road from San Francisco, and will be put in position as soon as possible. It is the intention of the owners to run the mill, and the mine also, winter as well as summer hereafter. The lower (No. 3) tunnel is to be immediately extended 200 feet (making its total length 1099 feet), and several additional stopes opened up from that level. The Lake View claim, the first southerly extension of the May Lundy vein, is also to be opened immediately, and steadily worked as a mine.

BODIE DISTRICT.

BODIE CONSOLIDATED.—It is said that Superintendent Irwin is about to resign his position. The annual meeting will take place in the early part of June. The report from the mines for the week ended May 19th shows that at the Bodie Consolidated mill there were crushed 150 tons of ore. This ore is from the 550 and 770-foot levels of the Lent shaft. At the Bodie Tunnel mill, there were crushed 342 tons, mostly from the Vulcan vein. The average assay value of the pulp is \$26.51, and of the tailings \$2.56.

BULWER CONSOLIDATED.—Three men are employed. The west cross-cut No. 2, 500-foot level, shows about 15 inches of vein in the face.

BODIE TUNNEL.—North drift, 200-foot level, the vein is 2 feet wide of free-milling ore. At the expiration of the Bodie lease, the Bodie Tunnel will continue running the same.

GOODSHAW.—The mine has been closed down. The company contemplates making improvements and putting on a large force of men next month.

STANDARD CONSOLIDATED.—During the week ended May 19th, twelve miners and one watchman at \$4 a day were employed. There has been a very marked decrease in the flow of surface water during the week, and it is thought that milling operations can shortly be resumed.

NEVADA COUNTY.

MAGENTA.—Water is coming in so fast at the mine that, in order to reach the 400 level, a larger pumping-engine is necessary. Arrangements have been made for the erection of an 8-stamp mill. In the mean time, the drain tunnel will be run to connect with the main shaft. In order to meet the expenses of these improvements, the company has levied an assessment of 4 cents a share upon the capital stock.

SAN BERNARDINO COUNTY.

BONANZA KING CONSOLIDATED.—The superintendent, under date of May 18th, writes as follows: In sinking on the ore from the northeast end of the fourth intermediate level, I find that it is making rapidly to the southeast as I gain in depth. Therefore we shall have to drive the east cross-cut fifth level north farther to the south and east before intersecting the ore on this level. The ore-body in the uprise above this winze is all of high grade, and continues in size with marked uniformity. To-day, we cut into a good showing of ore in the west cross-cut, sixth level north. The winze opposite the shaft fifth level is 20 feet deep. The ore-vein in the bottom is small. Bullion shipments for April amounted to \$47,552.55; so far this month, \$19,182.37.

COLORADO.

ARAPAHOE COUNTY.

Governor Grant, of the Grant Smelting-Works has stated to the Leadville Herald that all the furnaces at the Denver works were in blast. The company had about 80,000 tons of ore on hand the first of January, which has since been reduced almost 12,000 tons. The daily receipt of ore at present is considerably less than the consumption.

CHAFFEE COUNTY.

VENTURE.—A decision has been rendered in this mining suit, which has been in the courts for almost five years. The verdict was in favor of Messrs. Charles W. Taylor, James T. Rollins, and others. The defendants were Messrs. Miller, Smith, and others.

CLEAR CREEK COUNTY.

BIG BAR.—This mine, near Floyd Hill, has been purchased by a new company which will work it for gold. Hydraulic force will be used, and the surveys for the flumes, etc., have already been made.

KOHINOOR-DONALDSON.—The Silver Plume Coloradoan is authority for the statement that the Kohinoor-Donaldson mill, at Fall River, has been closed on account of the mine not producing sufficient ore to keep it running. It is stated that the mill was erected at a great expense and a tram built before any thing was known about the character of the mine.

GILPIN COUNTY.

A correspondent of the Denver Republican, writing from the Wide-Awake mining camp, some six miles northwest of Black Hawk, says that the great want of this camp is a custom stamp-mill, and very great inducements will be given to any capitalist who will go into the camp and examine the shipping capacities of the mines and erect a mill. One inducement offered is a splendid mill-site, with buildings already on the property, which could not be erected for less than several hundred dollars. This property, including all the improvements and a five-acre mill site, will be given to any party putting up a custom mill. This camp offers very great inducements to the prospector as well as to the man of wealth in the way of erecting one or more mills, as fifty stamps could at the present time be kept constantly running on high-grade free-milling ore. The wages paid to miners are \$3 a day.

Samuel Mellor, of Black Hawk, is arranging for the erection of a 15-stamp mill in Hawkeye District, which will be run by steam. It will be placed in what is known as Silver Gulch, a tributary of Stewart Gulch, within a convenient down-grade distance from the Free America and other recently discovered gold-bearing veins in that district. There is a sufficient supply of water and fuel near at hand to supply the mill. It is expected that the mill will be up and in running order within sixty days.

FRONTENAC.—On account of water, operations have been suspended. LUCKY PURCHASE.—The owners of this mine, Mountain House District, have made arrangements to start up development of that property. Machinery to facilitate deeper work on the property is to be purchased.

MANTOBA.—The work of development on this mine, in Vermilion District, has been resumed. It will require several weeks to relieve the main shaft of accumulated water since closing down operations some months ago.

LAKE COUNTY.

The Leadville Herald has the following: The receipts of ore at all the Leadville smelters continue very light, and most of the establishments, although running at only half capacity, are rapidly consuming their supply stocks of ore, and other smelters may soon be expected to follow the example of the La Plata works, and close down entirely. The Arkansas Valley has already anticipated the possibility of an entire suspension, and is regulating its ore mixtures so as to clean up as thoroughly as practicable the stock of ore on hand before closing down. The Arkansas people say that they will not operate their works unless they can keep at least three of their furnaces in blast. The Harrison Reduction-Works has been running with only two of its four furnaces in blast for over a month. The supply of ore, however, is so light that it has become a question how long even the reduced capacity of the smelter can be provided for; and the indications now are, that unless the production of desirable lead smelting ores

increases very soon, these works will also be forced to suspend, and wait until the ore-bins can be restocked with lead ore.

ADAMS.—Brookland shaft is again free from water, and the extraction of ore is going forward vigorously. The deep work from the Clontarf shaft has been suspended, owing to the great flow of water encountered, and corresponding levels are now driving from the Brookland shaft.

DUNKIN.—Captain Jenks has resigned his position as superintendent, and has been succeeded by Mr. D. V. Williams. The mine is looking well, especially in the northern workings, where there is a large body of iron ore, through which is disseminated some very high-grade ore.

FOREPAUGH.—Work continues on this mine east of the Robert E. Lee. The facilities for handling the water made by the shaft, which are very great, are inadequate, and it is expected soon to get either a large new plant or suspend exploration-work indefinitely.

IRON SILVER.—The output for April was 3683 tons. Prospect-work is still going on, and there is nothing of importance to report. Very good results are expected after July. The lessees of the south ore-dump on Iron Hill have begun work. The dump is one of the oldest and largest in the district, being started with the opening of the Iron mine in 1877, and containing several hundred thousand tons of waste rock and ore.

MINER BOY.—The hoisting machinery in the tunnel has started up. The shaft, which rises from the tunnel to the summit of the hill, extends down about 200 feet below the tunnel level. So far, all work by the present owners of the property has been confined to the vein above the tunnel. With the aid of the new plant, it is expected to work at greater depth, and open up portions of a vein known to be productive, but hitherto inaccessible on account of water. The mine has lately struck quite high-grade gold ore.

MORNING STAR.—Lessees on the Buckeye Belle shaft of the Morning Star Consolidation have uncovered a fine body of iron ore, directly under wash, and are preparing for ore-shipments. At the Morning Star mine, a drift driven east from the Kitchen shaft for 200 feet, has revealed a body of rich ore in a large piece of virgin ground.

SILVER CORD.—The annual meeting of the stockholders of the Silver Cord Combination Mining Company was held at Leadville May 21st. The meeting was an harmonious one, and the election resulted in retaining the old board of directors, with the exception of T. S. Wood, who declined the honor in favor of Mr. Burchard. The annual report of the operations of the company submitted by General Manager Wood showed a production during the fiscal year of 30,084 gross tons. The ore averaged 13 per cent in moisture, leaving a net product of 26,179 tons. These figures represent seven and a half months of working at full capacity and two and a half months during which development-work was carried on. The contents of the ore was as follows:

Gold	8,083.8 ounces
Silver	361,050.8 ounces
Lead	6,104.2 tons
Gross value at mine	\$714,740.72
Paid smelting charges	\$217,769.09
Gross receipts from smelters	\$496,973.33
Working expenses	39.22 per cent
Smelting cost	30.46 per cent
Profits	30.32 per cent
Cash on hand	\$18,000

The property is understood to show only limited resources in high-grade ore, but large quantities of medium and low-grade mineral, whose especial contents is lead, which, under the present depressed condition of the lead market, it was considered impracticable to market. The prospective value of the property is equal to any in the district, and the possibilities of opening up new and large ore-chutes may be considered as almost certain. The management of the property is to remain with Mr. Wood, whose course in the past was indorsed, and to whose discretion the resumption of work is left entirely.

TWIN LAKES.—The 2140-foot tunnel of this placer mining company is completed, and nothing remains now but to build a short flume, when the waters of Clear Creek can be used in working the company's extensive placer tracts. Washing has begun with water taken from Cash Creek, and seventy-five men are employed in mining and construction-work. In about ten days, the water from Clear Creek can be utilized, when operations will progress on an extensive scale. The water for these placers will then be brought from a point near Vicksburg, by a ditch, flume, and tunnel, constituting the largest water carriage for mining purposes in the State.

PARK COUNTY.

EAST LEADVILLE.—The Mudsill group of mines, near Horseshoe, and operated by this company, will soon resume operations and continue developments.

HOCK HOCKING.—During the past season, a large plant of expensive machinery has been erected, and preparations are making to thoroughly develop the ore-deposits proved to exist beneath the water-level. The ore is of a high grade, carrying a large percentage of lead.

LOGANSPORT.—The tunnel is in nearly six hundred feet, and opening into a strong vein of smelting ore.

LONDON.—About 30 men are daily employed. This property is capable of producing sufficient mineral of high grade to keep the large mill in constant operation, but the existing legal difficulties still prevent its continuous working.

SAN JUAN COUNTY.

The ore-shipments from Silverton, which are almost wholly to Denver smelters, started in at the rate of 150 tons a day, at the opening of the snow blockade, but, owing to the impassable condition of the roads to the mines, from melting snow and rains, very little is shipped. All of the old mines, with a number that have never shipped ore before, will be regular shippers, as soon as the roads are in condition to haul their ore down, and the prospects are, that the ore-shipments will average 200 tons during the season.

FRENCHBAYS.—The company, having raised the necessary funds by a recent issue of bonds, will very soon be prepared to resume work upon its properties on King Solomon Mountain.

SUMMIT COUNTY.

The Iron Mask and Little Belle mines, on Battle Mountain, have been sold for \$27,000.

COMBINED DISCOVERY.—During the past ten days, there were shipped eight car-loads of ore, ranging in value from \$600 to \$800 per car. The mine is employing twenty-five men. The ore contains from 15 to 30 per cent in lead, from 12 to 15 per cent in iron, from 30 to 40 per cent in silica, from 60 to 80 ounces in silver, and from one tenth to one half ounce in gold.

DAKOTA.

BENGAL TIGER.—Work has been pushed ever since last fall. The tunnel is now under cover a distance of 397 feet, the total length of cut and tunnel being 437 feet. The old shaft has been tapped, and it and all the old drifts drained. Work will be prosecuted throughout the season.

FATHER DE SMET.—Report for the week ended May 23d shows: Ore extracted from the first, second, and third levels, 1960 tons; tons of ore mined, 3000. Tramway header, third level, advanced 8 feet. Total length, 15 feet.

GOLDEN SUMMIT.—The company is to be reorganized.

GREAT WEST.—The mill began operations on the 5th instant.

GREENWOOD.—The company that was incorporated recently for the purpose of developing this group has made arrangements to begin extensive operations.

HOMESTEAK.—A tunnel is to be run to tap the B. and M. shaft in what was formerly the Giant & Old Abe mine, 400 feet from the surface. This tunnel will

be eight by ten in size, and will enable the ore train to haul ore to the new mill. Active work will begin at once.

MAINE.

DEER ISLE.—The company has been putting its engine and boiler in order, preparatory to pumping out the mine and resuming work. The officers of the reorganized company are as follows: President, John S. Morris; Treasurer, A. C. Libby; Directors, Messrs. Morris and Libby and Benjamin Thompson, all of Portland.

MICHIGAN.
COPPER MINES.

DETROIT & LAKE SUPERIOR.—The company is putting in the foundations for a new reverberatory furnace.

PEWABIC.—According to the Calumet News, nearly all the men lately taken on have been removed and the mine is still dragging along. The diamond drill was discontinued about ten days ago.

IRON MINES.

Lake shipments of iron ore from the ports of the Marquette District up to and including the 21st or May have been:

	Tons.
Escanaba, Marquette District	85,558
Menominee "	132,538
Marquette, Marquette "	32,026
L'Anse, "	840
St. Ignace, "	4,127
Total	255,089

DETROIT.—The mine shows poorly in ore. Some weeks since, while a fine 15-foot vein was worked, it was suddenly "headed," running into a solid wall of rock. A diamond drill in operation at the mine has bored a hole some 300 feet in depth, but as yet has struck only lean ore. There is but little ore at the mine, shipments having been going on to the Deer Lake Company's furnace since the mine was opened.

WINTHROP.—The large shaft started by the company some time ago has reached a depth of 200 feet, and will be sunk 200 feet more.

MONTANA.

SILVER BOW COUNTY.

MOULTON.—The 300 west drift is in splendid shape. There are two and a half feet of ore in the vein that averages over 100 ounces in silver and \$20 in gold. Messrs. J. M. Moore & Co., No. 78 Broadway, New York City, have been appointed transfer-agents, and the American Loan and Trust Company registrars of stock.

NEVADA.

ESMERALDA COUNTY.

MOUNT DIABLO.—Official reports state that, after paying all the expenses to May 1st, the company had a surplus of \$81,820.47. It is now engaged in opening up and developing the mine at a greater depth than it has heretofore worked, and this will occupy some four or five months' time. Since January last, no bullion has been produced, and the company will not probably be prepared to make another crushing of ores before October or November next.

EUREKA COUNTY.

EUREKA TUNNEL.—The sinking of the working-shaft from the 200 to the 300 level below the tunnel level has begun. There is a streak of ore going down with the shaft. The old stopes are worked and some ore extracted.

NEW JERSEY.

In the case of Charles W. Trotter against Charles A. Hecksher and the Lehigh Zinc and Iron Company, Vice-Chancellor Bird, at Trenton, May 24th, filed conclusions advising that the complainant's temporary injunction to restrain the defendants from taking possession of his valuable Franklinite ore mines in Sussex County be neither made permanent nor dissolved, but remain in abeyance till both parties carry out the terms of their agreement. The agreement was, that Trotter furnish 1000 tons of ore a month to the defendants; but he broke the agreement after shipping 8000 tons, because of difficulties with the complainant. The defendants then attempted to take possession of the mines. Millions are involved. As to the damage to the defendants, by the complainant's failure to ship, the vice-chancellor directs that they must be established at law.

NEW MEXICO.

GRANT COUNTY.

The machinery at Oak Grove, the smelter and all appliances, have been torn down and moved into Silver City, where they will become a part of the new reduction-works.

SIERRA COUNTY.

Official reports from the Sierra Grande, Sierra Bella, and Sierra Apache mining companies state that the prospects are encouraging. The branch railroad is finished, and the various tram-roads, ore-bins, and other facilities for shipping nearly so, and largely increased shipments are anticipated in the early future. The Grande Company has shipped \$50,000 of ore this month up to the 23d; Bella, about \$8000, owing to her branch road not being ready for use. It was to be finished about the 20th. In April, Grande shipped over \$41,000 ore, and Bella \$27,000.

VERMONT.

ELY COPPER MINES.—The court has appointed a receiver, and the legal and financial complications in which the owners of these mines at Vershire have been involved during the past year are in a fair way to be cleared up and settled, says a correspondent of the Boston Journal. On motion of the Vermont Copper Mining Company and of Hon. S. M. Gleason, the receiver, and also on the request of numerous creditors and bondholders, an order has been granted for the sale of the entire mining property. The receiver is ordered to sell at public or private sale all property in or about the village of Ely belonging to the Vermont Copper Mining Company, to the Vermont Copper Company, and to Ely Goddard and Cazin. The property comprises about 1200 acres of land, including the mines, furnaces, waste ore-beds and roast-beds, buildings and machinery, and all personal property. The receiver is ordered to convey the property to the purchaser free of all mortgages, attachments, liens, and incumbrances. The incumbrances on the property are to be attached by order of the chancellor to the purchase money, their relative priority to be held in the same order as they are now attached to the property itself. The controversies between the parties litigant and the claims of the various classes of bondholders and creditors are to be settled hereafter by the chancellor. The receiver has during the past few weeks caused the ore to be smelted that was on hand at the breaking out of the "Ely War." The mine is believed to be in as good condition as ever, and more ore is visible ready to be worked than has been known for years. The Ely mines for several years in succession produced more than 2,500,000 pounds of copper.

WASHINGTON.

The miners of the Swauk Mining District have held a mass-meeting and notified all Chinese that they must leave the diggings at once. It is not yet known what the Chinese will do. There are a large number of Celestials in the district, and should they refuse to go, trouble is anticipated.

FINANCIAL.

Gold and Silver Stocks.

NEW YORK, Thursday Evening, May 29.
Business was a little better this week in the mining market, the aggregate number of shares sold reaching 82,795, as against 63,025 last week. Prices, however, seemed to be on the decline, and the market ruled weak and unsettled. Especially was this the case with the Comstock shares, which were quite weak. The Leadville stocks were also on the decline, while the Bodie stocks ruled at about steady prices. A few of the low-priced shares record large sales, but at no material change in price. We give a complete summary of the market below.

The Comstock shares were dealt in at weak prices. California sold from 7@6c., with a small business. Consolidated Virginia was very active, and sold at weak prices; it was quoted from 17@14c. Sierra Nevada was weak, selling from \$1.65@1.10, and at 80c., assessment unpaid. Union Consolidated records but a small business at weak prices; it sold from \$1.80@1.50. Mexican sold at \$1.85. Yellow Jacket was moderately dealt in, and was a little weak, selling from \$2@1.80. Best & Belcher records one small transaction at \$2.25. Sutro Tunnel was very actively dealt in at steady prices; it sold from 11@12c.

The Leadville stocks were very quiet, and sold at weak prices. Amie was quoted from 6@5c., with a small business. There was a small lot of 25 shares of Chrysolite sold at 75c.; outside of this, the stock was neglected. Breece sold at 22c. Iron Silver was fairly dealt in at irregular prices; it sold from 85c. on Saturday to 94c. on Monday, but gradually declined during the week, and sold at 80c. to-day. Leadville sold at 30c. Little Chief was quiet, selling from 35@30c. Climax sold at 2c.

The Bodie stocks record a small business at irregular prices. Bodie Consolidated was moderately dealt in and was strong; it sold from \$3.55@4.60@4.35. Standard was weak, under a small business, selling from \$1.50@1@1.05. A 60-share lot sold at 75c. Bulwer was quiet and irregular, selling from 54@60@57c. Consolidated Pacific sold from 25@20c., with a small business.

The Tuscarora stocks were moderately dealt in at about steady prices. Belle Isle sold from 53@47@48c., with a fair business. Navajo was strong and was fairly dealt in; it sold from \$2.95@3.35. North Belle Isle sold at 20c. Independence was weak under a small business, selling from 27@22c.

In the miscellaneous list, a small lot of Bassick sold at \$6.50. Eureka Consolidated was quite weak, declining from \$3.25@2.70, under a small business. Father de Smet sold at \$2.90. Horn-Silver sold at \$6 throughout, and was moderately active. Robinson sold at 19c., and was very quiet. Silver King records a small business at steady prices; it sold from \$5@5.75. Stormont sold at 14c.

Caledonia records one transaction at 60c. Central Arizona was quiet and steady at 18c. Lacrosse was very actively dealt in and was a little weak; it sold from 12@10c. Rapahannock sold at 17c. with a fair business. Sonora Consolidated was moderately dealt in at steady prices, selling from 4@5c.

The Sierra Apache, the Sierra Bella and the Sierra Grande mining companies will hold their annual meetings at Lake Valley, New Mexico, on July 1st, at which the question of reducing the capital stock of each company is to be considered. The capital stock of the Sierra Apache and the Sierra Bella is now \$5,000,000, and it is proposed to reduce each one to the sum of \$1,000,000. The capital stock of the Sierra Grande, which is now \$10,000,000, it is proposed reduce to \$2,000,000. The object of this reduction has not been stated. The operations of the companies during the past year have shown no important developments, but the prospects at present are reported to be good. The Sierra Bella has paid but one dividend of \$30,000. The Sierra Grande has paid dividends to the amount of \$700,000.

In the suit brought by William T. Brown, on behalf of himself and other members of the American Mining Exchange against the Mutual Trust Company, Judge Van Brunt, of the Supreme Court, has decided that the Trust Company is responsible for the moneys deposited with them, and that it must account to the members therefor. He directs also that a new trustee be appointed. The Exchange was founded in 1880, the members making payment under a circular issued by

ex-Senators Thomas B. Jones and Alexander McDonald and others, in which it was stated that the \$1000 to be paid for seats was to be held in trust and invested, and was to be liable only for the indebtedness of members to each other; but no reference to the trust was made in the by-laws.

DIVIDENDS.

Charleston Mining and Manufacturing Company, of South Carolina, has declared a quarterly dividend of two dollars and fifty cents a share, and a special dividend of one dollar a share, payable June 2d, at No. 132 Walnut street, Philadelphia, Pa.

Derbec Blue Gravel Mining Company, of California, has declared a dividend (No. 3) of ten cents a share, payable at San Francisco, Cal., May 27th.

The Idaho Mining Company, of California, has declared a monthly dividend of \$15,500, or \$5 a share, on the capital stock.

The Lehigh Coal and Navigation Company, of Pennsylvania, has declared a semi-annual dividend of three per cent on the capital stock of the company, clear of taxes, payable on and after June 11th to stockholders as registered at the closing of the books on May 31st, at Philadelphia, Pa.

DIVIDENDS PAID BY MINING COMPANIES DURING THE MONTH OF MAY AND FROM JANUARY 1ST, 1884.

NAME OF COMPANY.	Location of mines.	Paid during month of May.	Since January 1st, 1884.
Atlantic, c.	Mich.		40,000
Bassick, c. s.	Cal.		100,000
Bodie Consolidated, c.	Cal.	50,000	150,000
Bonanza King Cons., s.	Cal.	25,000	125,000
Bulwer Consolidated, c.	Cal.		10,000
Calumet & Hecla, c.	Mich.		500,000
Carbonate Hill, s. l.	Cal.		10,000
Catalpa, s. l.	Cal.	30,000	30,000
Central, c.	Mich.		40,000
Copper Queen, c.	Ariz.		200,000
Cosmopolitan, s.	Utah.		25,000
Derbec Blue Gravel, c.	Cal.		20,000
Father de Smet, c.	Dak.	20,000	60,000
Hecla Cons., s.	Mont.	15,000	75,000
Homestake, c.	Dak.	25,000	125,000
Hope, s.	Mont.		12,000
Horn-Silver, s. l.	Utah.	300,000	600,000
Idaho, c.	Cal.	15,500	77,500
Iron Silver, s.	Cal.		100,000
Jocunita, s.	Mex.	50,000	140,000
Kentuck, s.	Nev.	3,000	15,000
Lexington, s.	Mont.		80,000
Little Chief, s. l.	Cal.	20,000	40,000
Mount Pleasant, c.	Cal.		15,000
Ontario, s.	Utah.	75,000	375,000
Original, c.	Mont.		9,000
Oro Grande, c.	Cal.		6,000
Osceola, c.	Mich.		25,000
Oxford, c.	N. S.		6,000
Paradise Valley, c.	Nev.		39,000
Plymouth Cons., c.	Cal.	50,000	250,000
Quicksilver, Pref., c.	Q.		12,900
Quincy, c.	Mich.		180,000
Rooks, c.	Vert.		8,500
Security, c. s. l. c. s. i.	Cal.		25,000
Sierra Bella, s.	N. Mex.	30,000	30,000
Small Hopes Con.	Cal.	58,000	100,000
Standard, Con., c.	Cal.		75,000
Syndicate, c.	Cal.		30,000
United Verde, c.	Ariz.		60,000
		\$758,500	3,771,900

G., gold; S., silver; L., lead; C., copper; Q., Quicksilver; C., coal; I., iron.

MEETINGS.

The following companies will hold their annual meeting for the election of trustees and the transaction of other business, at the times mentioned:

Belview Coal Company, office of company, Hite Station, Alleghany County, Pa., June 14th, at five o'clock P.M.

Brooklyn Lead Mining Company, No. 19 Park Place, New York City, June 7th, at one o'clock P.M. Meeting held for the purpose of considering and acting upon the matter of increasing the capital stock of the company from \$240,000, its present amount, to \$500,000, and of increasing the number of shares of stock from twenty-four thousand to fifty thousand, and to transact any other business proper to come before such meeting.

Schley Mining and Milling Company, office of E. H. Pratt, No. 34 Pine street, New York City, June 2d, at three o'clock P.M.

Sierra Apache Mining Company, office of company, Lake Valley, Sierra County, New Mexico, July 1st, at twelve o'clock M.

Sierra Bella Mining Company, office of company, Lake Valley, Sierra County, New Mexico, July 1st, at twelve o'clock M.

Sierra Grande Mining Company, office of company, Lake Valley, Sierra County, New Mexico, July 1st, at twelve o'clock M.

PIPE LINE CERTIFICATES.

The petroleum market this week was of a rather irregular character. Opening on Saturday at 73½c., it rallied to 74c. and declined to 72½c., closing at 72½c. On Monday, oil opened at 72½c., and rose gradually until Tuesday, when it reached the highest price of the week, 79½c. Wednesday, the market opened at 79c., and slowly declined, reaching 75½c. to-day, but closing firmer at 77½c.

The following table gives the quotations and sales at the New York Mining Stock and National Petroleum Exchange:

	Opening.	Highest.	Lowest.	Closing.	Sales.
May 24	\$0.73½	\$0.74	\$0.72½	\$0.72½	4,585,000
26	.72½	.74½	.72½	.74½	6,001,000
27	.75	.79½	.75	.79½	8,369,000
28	.79	.79	.79	.77½	6,709,000
29	.79½	.79½	.75½	.77½	9,122,000
30					
Total sales					34,796,000

SAN FRANCISCO MINING STOCK QUOTATIONS. Daily Range of Prices for the Week.

NAME OF COMPANY.	CLOSING QUOTATIONS.					
	May 23.	May 24.	May 26.	May 27.	May 28.	May 29.
Albion						
Alpha						
Alta	2	1½	1½	1½	1½	
Argenta						
Bechtel						
Belcher		1	1		1	
Belle Isle						
Best & Belcher	2	1½	1½	1½	1½	
Bodie	3½	3½	4½	3½	3½	
Bullion						
Bulwer						
California	15	10	15	15	10	
Chollar	1½	1½	1½	1½	1½	
Con. Pacific						
Con. Virginia	20	15	15	25	25	
Crown Point	1½	1½	1½	1½	1½	
Day						
Eiko Cons						
Eureka Cons	3½	2½	2½	2½	2½	
Exchequer						
Gould & Curry	1½	1½	1½	1½	1½	
Grand Prize						
Hale & Norcross	2½	2½	2½	2½	2½	
Independence						
Martin White						
Mexican	1½	1½	1½	1½	1½	
Mono						
Mount Diablo		2½		2½	2½	
Navajo	3½	3	3½	3½	3	
Northern Belle						
North Belle Isle						
Ophir	1½	1	1½	1	1	
Overman						
Potosi	60	55	60	40	50	
Savage	80	80	80	75	70	
Scorpion						
Sierra Nevada	1½	1½	1½	1½	1	
Silver King						
Tip Top						
Union Cons.	1½	1½	1½	1½	1½	
Utah	80	80	80	65	70	
Wales Cons.						
Yellow Jacket	2		2	1½	1½	

Copper and Silver Stocks.

Reported by C. H. Smith, 15 Congress street, Boston, Stock Broker and Member of the Boston Mining and Stock Exchanges.

BOSTON, May 28.

The market for mining stocks continues dull, with prices settling gradually to a lower level, and there is no indication at present of a revival of the activity which prevailed a few years since. In copper stocks, the dealings are now almost altogether confined to one or two of the leading mines, while silver stocks seem to be entirely neglected and forgotten. This is due, not to a want of enterprises in which to take flyers, for there are not lacking plenty of opportunities, but rather to a want of confidence in the enterprises themselves, and in the parties who manage them. The dealings in Calumet & Hecla the past week have been very light, less than 100 shares changing hands in small lots at a decline from \$170 to \$167 as the extremes, the closing price to-day being \$167½ bid. In Quincy, there is no change in price, and only a few shares sold, the last sale being at \$36, with \$36½ bid. Pewabic is in little better demand and sold at \$1½@1½, against \$1 last week. A sale of 500 shares of Minnesota is reported at 25c.; this exhausts the list of dealings. The rest of the list is neglected.

At the Boston Mining and Stock Exchange, business is at a stand-still; the attendance is very small, and there are but few transactions. About the only mining stock in which there is any thing doing is Bowman Silver, but even this is dull, with a tendency to lower prices. Sales are reported at 10@13c., the lowest price made to-day. Quotations were made of Dunkin

at 17@20c. Empire, at 8c. Sullivan, at 8c. Mascot, at 50@57½c. Catalpa, at 37½@40c. Douglas Copper, 35c., assessment 10c. paid, but sales are few and far between.

3 P.M.—There was nothing doing at the afternoon Board excepting a single share of Quincy, which sold at \$36½. The closing prices are: Allouez, ½ bid. Atlantic, \$7 bid, \$8 asked. Bonanza, \$1 bid. Calumet & Hecla, \$167 bid, \$167½ asked. Franklin, \$7 bid. Osceola, \$10 bid, \$12½ asked. Pewabic, \$1½ bid. Quincy, \$36½ bid, \$36½ asked. Bowman, \$½ bid, 14c. asked.

BULLION MARKET.

NEW YORK, Thursday Evening, May 29.

The silver market has declined abroad and been depressed here by sympathy and by lower rates for sterling exchange.

DATE.	London.	N. Y.	DATE.	London.	N. Y.
	Pence.	Cents.		Pence.	Cents.
May 24	50 15-16	111	May 28	50 13-16	110½
26	50 15-16	110¾	29	50 13-16	110½
27	50½	110%	30		

BULLION PRODUCTION FOR 1884.

MINES.	States.	Month of April.	Year from Jan. 1st, 1884.	
			\$	¢
*Alice, g. s.	Mont.		298,761	
*Belmont.	Mont.		8,081	
Bodie, g.	Cal.	120,499	209,475	
*Bonanza King, s.	Cal.	56,730	191,891	
*Boston & Montana, g.	Mont.	37,483	170,296	
*Chrysolite, s. l.	Colo.	20,095	52,373	
*Consolidated Bobtail, g.	Colo.		24,326	
*Contention, s. g.	Ariz.	65,010	260,174	
*Deadwood-Terra, g.	Dak.		128,703	
*Derbec Blue Gravel, g. s.	Colo.	12,732	42,028	
*Father de Smet, g.	Dak.	40,986	137,061	
Grand Prize, s.	Nev.		35,000	
*Hecla Cons., g. s. l.	Mont.		132,178	
*Homestake, g.	Dak.		301,053	
*Hope, s.	Mont.		17,980	
Horn-Silver, s. l.	Utah.	168,000	750,087	
*Iron Silver, s. l.	Colo.	67,963	252,132	
*Kentuck, g. s.	Nev.	3,508	15,147	
*Lexington, g. s.	Mont.	98,477	398,373	
*Little Pittsburg, s.	Colo.	12,000	37,134	
Moulton, s.	Mont.		122,000	
*Mount Diablo, s.	Nev.		24,820	
*Ontario, g. s. l.	Nev.	29,268	115,018	
*Orlando, s. l.	Utah.		536,205	
*Original, s. c.	Mont.		11,135	
*Oxford, g.	N. S.	4,090	14,352	
*Paradise Valley, s. g.	Nev.		45,164	
*Plymouth Consolidated, g.	Cal.	88,399	364,177	
*Rooks, g.	Vt.	3,443	11,376	
*South Yuba, g.	Cal.	2,637	8,456	
*Syndicate, g. s.	Cal.	12,419	48,260	
*Tombstone, s. l.	Ariz.	88,094	302,682	
United Gregory, g.	Colo.		7,174	

Total amount of shipments to date.....\$5,085,149

* Official. † Assay value. ‡ Not including value of lead. G. Gold; S. Silver; L. Lead; C. Copper.

METALS.

NEW YORK, Thursday Evening, May 29.

Copper.—Sales for the week have not exceeded 100,000 pounds Lake Superior at 14½c., other brands being nominally worth 13½@13¾c. The market has been excessively dull, but in this it does not differ from all other metals, and, in fact, merchandise generally. The occurrences in Wall street and elsewhere during the month have, it appears, made a deeper impression on trade than was at first believed would be the case. Consumers seem determined to operate from hand to mouth only, however cheap apparently a metal may be, and however well it may be situated from a statistical point of view. As for copper in particular, there is, besides, an apprehension that the output this year will be even larger than that of last year, with a less favorable market for what we may have to spare Europe. The Calumet & Hecla Company alone, it is believed, will produce this year something like 40,000,000 pounds. Should this be the case, and there be a notable increase too beyond the Mississippi, nobody can say where the price may finally go to, and the sale which the lake companies effected in Europe in March may, after all, not prove much of a bargain for those who will be the receivers of it. The latest cablegrams from London quote Chili Bars £56 and Best Selected £62.

Tin.—London has been unusually steady during the week, being last cabled £83 15s. Straits. Our own market shows listlessness, and fluctuates between 18½@19c. There is no doubt the position of the metal is statistically better than it has been for a year or

two past, both here and in Europe. Shipments this way from the Straits settlements during the first quarter have been only 15,724 piculs of 134 pounds, against 26,685 in 1883, and the stock is light, but the depression in trade prevents an improvement. If the consumptive demand should come forward vigorously to-morrow, the metal would be susceptible of a smart advance, even without the help of operators for a rise. As it is, the metal remains sluggish.

Lead.—As had been presumed, the real purpose of the Chicago meeting of May 22d and 23d has not been carried out; all that has been accomplished, it seems, is an agreement between several parties representing important interests to act in concert as to the rates to be made and the price to be accepted, but their joint action, they say, is to be swayed by circumstances. This being the outcome, it has had any thing but a briskening effect on our market, which shows perceptible signs of weakness, for after from 400 to 500 tons common domestic have been disposed of since we last reported at 3¾c., this figure can not now be repeated, lead being vainly offered at this price. Whether, after the joint effort to bolster up the price failed, the main operator will again try his hand at the metal, after perhaps first seeking to depress it, remains to be seen. The best would probably be to let lead shape its own course; for if production, as is asserted, is very moderate just now, the metal may show vitality enough to right again of its own accord so soon as the time for the shot demand approaches. Meanwhile we hear that the sale of white lead is much lighter than last year at this time. London quotes soft Spanish £11 12s. 6d.

Messrs. John Wahl & Co., of St. Louis, telegraph us as follows to-day:

Our market is gradually assuming a quieter aspect, and the demand is not quite as good as last week. Business during the week has been very quiet, and sales are of a retail character. A few sales of Refined Lead were made at 3½c. and 3½c. Common could not be placed at 3½c.

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

Our market has declined slowly since our last report. There is but little doing, and the demand is from hand to mouth only. Our market closed nominally at from 3½@3½½c. Sales during the week amount to about 600 tons at from 3½½@3½c.

Spelter.—Sales have been effected on a very moderate scale at \$4.60 during the week, at which figure the metal remains firm. London cables ordinary £14 2s. 6d. at shipping port.

Antimony.—Has been in light request at 10½c. Hallett's, and 11c. Cookson's.

IRON MARKET REVIEW.

NEW YORK, Thursday Evening, May 29.

American Pig.—There is no change in the market to report, and the trade continues very dull. There is some little inquiry for small lots, but the bulk of business done is confined to deliveries on old contracts. Prices remain firm for the best brands, notably of No. 1 and Gray Forge, while No. 2 Foundry is in more ample supply.

We quote No. 1 Foundry at \$20@21; No. 2, \$19@19.50; and Gray Forge, \$17.50@18.50. There have been no sales of domestic Bessemer pig. Foreign remains quiet at \$20 ex ship. Twenty per cent Spiegel is quoted in round lots at \$28@28.50 ex ship, some sales having been made at the lower figure. Ferro-manganese, 45 per cent, is worth \$45.

Scotch Pig.—The trade continues exceedingly dull, there being but a few small lots sold for immediate wants. During the week, about 1000 tons arrived, the most of which was put into store, as sales from dock could not be made except at great loss.

We quote ex ship and to arrive: Coltness, \$21.50@22; Langloan, \$22@22.50; Summerlee, \$21; Dalmellington, \$20; Gartsherrie, \$21.25@22; Eglinton, \$19.50@20; and Glengarnock, \$21.50@22.

At the Metal Exchange, the following cable quotations have been received: Coltness, 56s. 6d.; Langloan, 52s. 6d.; Summerlee, 51s.; Gartsherrie, 51s.; Glengarnock, at Ardrossan, 50s. 6d.; Dalmellington, 47s. 6d.; and Eglinton, 44s. 3d. Warrants, 41s. 2d.

Steel Rails.—There has been no business of any importance. We quote \$32@32.50 at mill.

Old Rails.—We quote \$19@20.

Philadelphia.

May 28.

[From our Special Correspondent.]

Pig-Iron.—Brokers and representatives of the leading furnace companies here report the business in pig-iron for the past week as about up to the average for the past few weeks, and about equal to the production. Prices for the better makes are very firm, and stocks light. There are large stocks of inferior irons, which sell very slowly and at heavily shaded prices. Quotations are unchanged at \$20@21 for No. 1 Foundry; \$18.50@19.50 for No. 2; and \$17.50@18 for Gray Forge. There is some inquiry for American Bessemer, but no probability of sales, as stocks are held at \$18 at furnace, with only slight concessions to be had, while buyers are talking about \$16.50@17.

Foreign Iron.—There is no business whatever in Bessemer pig. Quotations are nominally unchanged at \$19 asked. Spiegeleisen is selling in a small way at \$27.50@28 for 20 per cent.

Muck-Bars.—No transactions are reported. Prices are quoted at \$32@33.

Manufactured Iron.—The market remains unchanged. Demand is rather slack, although the aggregate of business is about the same as for last week. Best Refined Bars are selling at 2c. In interior mills, prices may be called steady, but it is only because they have declined to the lowest possible limit, and manufacturers would prefer shutting down to granting any further concessions. Iron of inferior quality is selling as low as 1.80c.

Plate and Tank-Iron.—A few fair orders have been placed during the past week, but only at concessions from the quoted rates. There are no large inquiries on the market, and though the retail demand is fair, the mills have only enough to keep them busy on single turn, with very little work assured for the future. Quotations are unchanged at 2.10@2.20c. for Common Plates, 2.75c. for Shell, 3.75c. for Flange, and 4.75c. for Fire-Box.

Structural Iron.—The usual small business is coming in, but there is nothing of moment to be reported. Quotations are nominally unchanged, but shadings could be obtained on good orders.

Nails.—There is fair demand for small lots, but prices are weak, and will probably decline to still lower limits; \$2.50@2.60 are the nominal quotations, but less is frequently accepted.

Steel Rails.—In spite of the fact that \$32 has been generally spoken of as the price to be accepted for winter deliveries, representatives of the leading Bessemer steel companies stated to-day that, for the ordinary business coming in, they would not accept less than \$33, though 50c. less might be accepted later on for large orders. The mills are busy on small orders and in finishing up old contracts, and though anxious for new business, makers are not disposed to let prices sink any lower until they are compelled by competition to do so, or close their mills.

Old Rails.—The market is without the least sign of activity, and brokers report it impossible to place business. Prices are weak, and stocks are offered at \$21.50. Bridge rails are quoted at \$23.50@24. D. H. rails, \$23.50.

Scrap-Iron.—The market is dull and quiet, with no sales of any importance. Quotations are \$23@23.50 for No. 1, with \$21@21.50 for cargo lots.

Pittsburg.

May 29.

[From our Special Correspondent.]

Pig-Iron.—The report of sales of pig the week just passed carried out my prediction that they would be heavier than the week previous. Reported sales footed 1115 tons, and I hear of private sales, but could get no figures. The dullness in trade continues, but a change is expected next week, when the uncertainty about the mills continuing will come to an end, and either the best or the worst be known. To bring iron wages matters to a crisis, the manufacturers asked the court to grant them a license for an iron trade tribunal, which is similar to the coal trade tribunal in that it allows a board of arbitrators equal in number from both sides, they to choose an umpire, who is to decide all questions at issue, provided the board can arrive at no conclusion. The workings of a tribunal are necessarily very slow, and as the men have signified no intention thus far of joining in it, the arbitration plan will have little to do with ending the present dispute. As I understand the Amalgamated Association, it can not by its constitution change the mode of settling wages disputes, so it will simply ignore the whole matter. It presented

NEW YORK MINING STOCKS.

DIVIDEND-PAYING MINES.

NAME AND LOCATION OF COMPANY.	HIGHEST AND LOWEST PRICES PER SHARE AT WHICH SALES WERE MADE.												SALES.
	May 24.		May 26.		May 27.		May 28.		May 29.		May 30.		
	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	
Alice Mon.													4,000
Amie Con., Co.			.06				.06		.05				30
Bassick, Co.					6.50								3,900
Belle Isle, Ne.	.58		.52	.50	.51		.48	.47					895
Bodie Cons., Ca.	3.55		3.70		4.60	4.40	4.25		4.35				140
Breece, Co.			.22				.54	.50	.57				2,200
Bulwer, Ca.			.06				.07		.06				4,390
Cal. & Hecla, Mich.													20
Castle Creek							.75						11,000
Chrysolite, Co.	.17	.16	.15	.14	.15		.15		.14				540
Cons. Va., Ne.													300
Deadwood Terra, Di.													2.70
Dunkin, Co.	3.25		3.25		3.25								540
Eureka Cons., Ne.	2.90												300
Father de Smet, Dk.													
Findley, Ga.													
Gold Stripe, Ca.													
Gould & Curry, Ne.													
Grand Prize, Ne.													
Green Mountain, Ca.													
Hale & Norcross, Ne.													
Hall-Anderson, N. S.													
Homestake, Dk.			6.00		6.00		6.00		6.00				2,950
Horn-Silver, Ut.													1,500
Independence, Ne.	.27						.22						6,200
Iron Silver, Co.	.87	.85	.94	.92	.85		.81	.80	.80				100
Leadville C., Co.							.30						1,600
Little Chief, Co.									.39				17
Little Pittsburg, Co.													
Martin White, Ne.													
Navajo, Ne.	3.05		2.90				3.30		3.35				2,500
Northern Belle													
North Belle Isle, Ne.			.20										400
Ontario, Ut.							1.75						100
Ophir, Ne.													
Quicksilver Pref., Ca.													
Robinson Cons., Co.	.19												700
Savage, Ne.	1.65	1.55			1.20	1.10			.80				965
Sierra Nevada, Ne.	5.25				5.00		5.75						150
Silver King, Ar.													1,600
Spring Valley, Ca.	1.50	1.25			.75		1.10		1.05	1.00			500
Standard, Ca.													
Stormont, Ut.	.14												
Tip Top, Ar.													
Virginia, Ar.													
Yellow Jacket	2.00						1.80						500

NON-DIVIDEND-PAYING MINES.

NAME AND LOCATION OF COMPANY.	HIGHEST AND LOWEST PRICES PER SHARE AT WHICH SALE WERE MADE.												SALES.
	May 24.		May 26.		May 27.		May 28.		May 29.		May 30.		
	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	
American Flag													
Barcelons, G.													
Rechtel Con., G.													
Belvidere													
Best & Picher, G. S.	2.25												25
Big Pittsburg, S. L.													
Bradshaw, S.													
Bull-Domingo, S. L.													
Cal., B. H., G.	.60												100
Central Arizona, S.									.18				300
Citmax, Co.	.02												500
Colorado Central													
Cons. Imperial									.25		.30		900
Con. Pacific													
Decatur													
Durango, G.													
Eastern Oregon													
Goodshaw, G.													
Harlem M. & M. Co.													
Hortense, S.													
Lacrosse, G.	.11	.10							.19	.10	.11	.10	12,100
Mariposa Pref., G.													
Mexican, G. S.	1.55												250
Mono	1.50												
North Standard, G.													
N. Horn-Silver, S. L.													
Oriental & Miller, S.													
Rappahannock, G.											.17		4,500
Red Elephant, S.													
Ruby, of Arizona													
Silver Cliff, S.													
Sonora Con.									.05		.04	.05	4,800
South Bodie, G.													
South Bulwer, G.													
South Hite													
South Pacific													
State Line, 1 & 4, S.													
St. Nos. 2 & 3, S.													
Sutro Tunnel	.11		.11						.11		.11		12,100
Taylor Plumas													
Unadilla, S.													
Union Cons., G. S.									1.80		1.85	1.65	1,500

Full tables giving the total amount of dividends, capital, etc., will be printed the first week of each month. Dividend shares sold, 47,070 Non-dividend shares sold, 35,725.

its scales to the individual manufacturers last Saturday, and they will be answered either affirmatively or negatively this Saturday. According to present indications, they will be signed and work continue, and the manufacturers will attempt to have the tribunal plan adopted for the settlements to come hereafter. Consumers of pig-iron are buying sparingly. The production is about the same, but as some mills will shut down, scale or no scale, for repairs, consumption will, if any thing, diminish somewhat the coming month; stocks in the mills are low. Prices are unchanged, the quotations of last week holding good this.

Manufactured Iron.—Bar mills continue to report business dull, but the specialty makers are reasonably busy. There have been some sales of skelp iron, but at unsatisfactory prices to makers. Structural and bridge builders have about all they can do. The general complaint, however, is that prices are unremunerative, except in the last two lines mentioned.

Muck-Bar.—The last sales reported were at \$30.50 and \$31, 4 months. These prices are weak and the market is dull.

Nails.—The trade for some reason continues dull. It should be better, for the condition of the building trades warrants it. The consumption is large, but jobbers are selling stock and buying only for orders. They should free their minds from the illusion that prices are to be lower, as manufacturers say not. They are as quoted last week.

Wrought-Iron Pipe.—The trade is unchanged, as are prices. Trade is dull.

Steel.—The merchant steel trade is fair, and a number of mills are well supplied with orders. Prices are unchanged, however.

Steel Rails.—The quotation is still \$35. No sales are reported. The reduction of 10 per cent at the Edgar Thomson mills will affect about 100 salaried boss workmen, and will be accepted. It goes into effect June 1st.

COAL TRADE REVIEW.

NEW YORK, Thursday Evening, May 29.

Anthracite.

The situation of the anthracite coal trade remains unimproved. There seems to be a great diversity of opinion as to the course of the trade for the next two or three months. The domestic consumer is

apathetic and the dealer is disposed to take his chances in the market. The consequence is, there is no confidence anywhere.

That the coal trade should be in this depressed condition is not at all singular when we bear in mind the fact that every other branch of industry is in about the same position. However, there are a number of causes, both direct and indirect, which have led up to the present situation. There is no disguising the fact, that the large sizes of anthracite coal for steam purposes have been displaced to a greater extent than the anthracite managers are willing to admit, by the various soft coals which have been brought into the market this year with a seeming indifference as to price, but apparently with the only desire to place the coal. The facilities for the distribution of anthracite coal are so great at present that the wants of the dealer or consumer can be immediately met, and there would seem to be no occasion for the laying in of large stocks. The producer and the trader are nearer together than they have ever been, and any wants on the part of one can be instantly supplied by the other excepting, of course, in the case of strikes or turn-outs or unusual interruptions of the production of coal. The trade seems to be more and more indifferent about early spring or summer purchases, feeling that when its business springs up it can get it supply without any disadvantage through waiting. In other words, that it does not pay it to buy coal in April and May to deliver in July and August. It seems a misfortune, knowing that a given quantity of coal will be required, that the distribution of it can not be made more equal during the year, instead of bunching the business into a few months, as must necessarily be the case under such circumstances as the present. There can be no doubt that later in the season the price of coal will advance, unless there should be a disruption of the harmony between the managers of the various companies, of which there seems to be no danger at the present time, and those who delay too long in making their purchases may possibly be obliged to make them at less advantage than they could now. However, we do not think it wise to attempt to advance prices at present, as we understand it has been the desire of some of the companies to do. The fact of a suspension of two entire weeks in June, the first and third, shows that a weak market can only be protected by deplet-

ing the stock of coal, and we do not think that a menace of an advance of prices under this self-confessed weakness of the situation would stimulate any new buying. On the contrary, we think that most of the buyers would resent the attempt and hold off, await developments and take their chances. The situation is one that demands conservatism and as little irritation as possible.

Bituminous.

Business in bituminous is limited chiefly at present to deliveries upon contracts previously made, of which the vessel supply has been more favorable than for some time past. It is quietly reported that the Cumberland field proposes to equalize the rate of wages with that prevailing in Clearfield, and the combination between the companies to effect such a purpose would appear to guarantee the success of any such movement. It is also reported that vigorous efforts are making to secure the reorganization of the Chesapeake & Ohio Canal directory upon a basis that will be in more harmonious accord with the trade, and the widespread interests identified with the business and the maintenance of that work. It is certainly evident that, in competitions for trade, the Canal Company has been asleep while its more active rivals have been appropriating the revenues. We note an increasing disposition on the part of anthracite consumers to investigate the merits and advantages of bituminous coal.

Philadelphia.

May 28.

[From our Special Correspondent.]

As has been indicated at various times in this report, the anthracite interests have found it necessary to agree upon a suspension, which will take place on the 2d, 3d, 4th, 5th, 6th, 7th, 16th, 17th, 18th, 19th, 20th, and 21st days of June, making twelve days in all. This action has been discounted in this market. As to its effect, it is not possible to say what the outcome will be. There are good coal authorities here who say that this restriction must necessarily be followed by others, and make out a sort of logical case. These reasoners are strong in the belief that the decadence in demand will be strong enough in all directions to call for a further restriction, even after the opening of the busy season. The representatives of the companies think that after the 1st, or at least by the middle of the month, an improving demand for

BOSTON MINING STOCKS.

	May 23.		May 24.		May 26.		May 27.		May 28.		May 29.		Sales.
	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	
Amie													
Bonanza D.			1.00				1.13						125
Bowman Sil	.16	.16	.50	.15	.10	.14	.15	.14	.14	.18			9,300
Bulwer													100
Cal. & Rec.	189	189	197		167 1/2	167	167 1/2	167	167 1/2	37 1/2			77
Catalpa	.40		.38		.28	.37 1/2	.40	.38	.38				100
Co. Virginia	.18				.19								2,250
Crescent	.12 1/2												300
"Cust"													100
Deceatur									.02				1,500
Dunkin	.18	.17	.19		.19				.18				2,500
Douglas									.35				100
Eureka Con									3.25				30
Franklin													500
Maseot.	.57 1/2				.55				.55				3,400
Minnesota									.25				500
Oscola	12.50												6
Pewabic	1.00				1.00				1.25				375
Quincy	36.25	36.13			36.50	36.25	36.00		36.50				23
Robinson									1.38				20
Standard									.08				900
Sullivan					.08				.08				500
Sutro Tun.	.12		.12						.12				

PHILADELPHIA MINING STOCKS.

	May 23.		May 24.		May 26.		May 27.		May 28.		May 29.		Sales.
	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	
Argent					.09								1,000
Cincinnati					.08								2,500
Comprom'e.	.10												500
Contention													100
Denver City													100
Iowa Gulch													2,250
Mt. Sheridan													300
Palmetto E.													100
Penn-Breck													1,500
Pinarro					.01								2,500
Rara Avis					.05								100
Rara Avis E.													100
Sierra Apac.													30
Sierra Beia.													500
Sierra G'nde					.72 1/2								3,400
Sierra Nev.													500
Silver Cord													6
Sutro Tun'									.80				375
Tombstone													23

anthracite will set in. The condition of the market here and at remote points has been very carefully investigated, and it is well known that stocks are light; but, on the other hand, the large buyers especially are backward about rushing into the market, and it is doubtful whether they can be induced to come in as soon as they are expected and desired to do. Ever since the opening of the year, coal has been on the down grade, and buyers say there is nothing to prevent further weakness. Agitators are going all through the region trying to stir up the spirit of organization, and meetings have been held at various places and the emissaries of the Miners' Association have been listened to respectfully, but there seems to be very little disposition to engage in a struggle against fate. The attempt has been given up and the agents will return home. Considerable destitution prevails in the anthracite regions, owing to low wages and short work. Work was suspended on Saturday at the Pottsville shafts, at Ashland, and Girardville. These mines have been worked at considerable disadvantage recently by the Philadelphia & Reading Company. One thousand men were thrown out of employment by this action, but they will probably find work at other mines where coal can be produced at a little less cost. There are rumors on the street to-day that some two or three collieries will be put on the retired list. Some of the larger sizes are unsalable. There are no indications of any improvement in the manufacturing demand in the eastern end of the State. The iron trade is in bad shape. The manufacturers here are not thinking of buying as early as usual. There is something in the shape of an agitation going on in one or two of the local papers against what they term "discriminations," and an effort will be made to stir up some sensational newspaper talk. These questions have been discussed at intervals for years past, and while the public take a great deal of interest in them, nothing has been done. Stocks at Port Richmond to-day are 104,066 tons. The leading coal men say that twelve days' restriction on next month will keep things solid for July. Good authorities say that, should there be any scarcity, it will show itself in stove sizes of special coals. With all the restriction, circular rates are heavily shaded. There is still a scarcity of vessels. Two or three weeks will effect a considerable reduction in Port Richmond stocks. Advices to-day from the Clearfield region give the production for last week at 71,563 tons; total for the year 1,199,156 tons; for the corresponding week last year, the production was 49,601 tons, and for the corresponding period of last year, 1,118,899 tons, showing an increase in the week's tonnage for the current year of 21,962, and in production to date of 82,257 tons. The Clearfield operators are not making much money, but they are having lots of fun.

Pittsburg. May 29.

[From our Special Correspondent.]

Coal trade features are marked with much sameness. The river is working partly again, and the railroad, as reported last week. In coke, I can find little out of the ordinary.

The river mines are working at the new rates of which I told you last week, namely, 8 cents for the first and second pools, 2 1/2 cents for the third pool, and 2 1/2 cents for the fourth pool. Your readers may wonder how it is that trade reports from this city are largely made up of wages matters, but the truth is,

wages troubles are possibly the most important things the operators in this vicinity have to meet. There have always been contests between master and man, which make the business here precarious. Each side is trying to keep the upper hand, and it looks now as though the operators were ahead. Some three years ago, they had mining done in the lower pools as low as 2 1/2 and 2 1/2 cents, but from that time the miners' organization got so strong that they ran the price up to 3 1/2 cents, and even wanted 4. Lately, circumstances have been against the men, and they have become disorganized, accepting reductions until they have arrived at the level given above. The start-up at this price has not been full, as it is too early for a summer's run, but the men are anxious to work wherever it is given them. Business is dull, and the operators will be out of pocket for a month or two all they pay for mining. Prices have stiffened at Cincinnati, and are back to 8 cents, and 7 1/2 cents at Louisville. Stocks are good in first hands down the river, but they are holding on to them, as we can not reasonably expect boating water for a month or two. The local trade here also continues dull, but it will not grow much duller at either the river or railroad mills, as they will probably continue to work through the summer, except where shut-downs are made for purposes of repair. I might also say that Fassett, Brown & Munhall, in the second pool, are having a contest with their men to go to work at 2 1/2 cents. These are the firms of which I informed you last week, who are determined to have their men work a quarter of a cent under the prices paid by other operators. I learn to-day that the third-pool miners are opposed to the reduction. They have called a convention for next Saturday, and they may resolve to strike. The miners' officers are anxious to inaugurate a strike along the river for better rates, but it can not be positively stated whether the men will be guided by their advice or not.

Matters new in the railroad trade principally refer to the Coal Trade Tribunal. The miners' officers have called a convention for June 17th, to consider the tribunal and elect members to serve the coming year. They will increase the membership from five to seven, as the operators propose to do the same in order to extend the benefit of the tribunal to the Pittsburgh, Virginia & Charleston, the Tom's Run, and the Baltimore & Ohio districts. Representatives of these districts were at the meeting of operators of which I told you last week, when they elected W. A. McIntosh, D. Reisinger, Thomas Dickson, A. J. Schulte, and Roger Hartley members for the year. Two new operators will be elected shortly who will represent the operators of the new districts. This extension of the tribunal will increase the number of pits controlled by it from 32 to 52, and place about 2000 more miners under it. This is about all the pits of consequence in the Pittsburgh region excepting two on the Baltimore & Ohio road, and it speaks well for the excellence of arbitration under the tribunal. The scarcity of cars that prevailed last week is remedied to a certain extent this week. The Mansfield Coal Company and other concerns had been shut down for several days owing to this reason. The subject of natural gas will probably not be discussed by the tribunal until it meets to arrange the fall and winter scales. The mines will be compelled to

meet it intelligently and work for the coal that compete with gas at a figure under the tribunal rate. It will either be that or that they have no work at all. Coal operators believe gas can not be furnished much cheaper than at present, and expect to successfully hold their own against it by having cheaper mining. The price on the wall remains at 5 1/2 cents, with some sales a very small fraction under, but not low enough to quote. I am under the impression that the mills will continue at work, and this important branch of the trade will not be taken away. Next week will tell the story.

Coke prices and trade are totally unchanged. The independent operators will probably join the Producers' Association. I have it from reliable authority that they believe they can be benefited, and will enter the pool. They are now observing the Thursday shut-down, and have been for three weeks past, which is considered the first step toward pooling. An excellent article of coke is produced by the pool, much better, in fact, than before it was organized, and the best customers in the trade will have none but the pooled coke.

Buffalo. May 28.

[From our Special Correspondent.]

The principal miners and shippers of anthracite coal are absent from our city, being on their way to attend the meeting of the Joint Committee of Fifteen in New York to-morrow. While it is not unlikely that some or each of them may be cognizant of slight irregularities, the prices and conditions of sales, as a whole, have been strictly lived up to, and the dealers in Buffalo have never acted with more harmony than they are doing at the present time.

The suspension of mining, as agreed upon by the presidents of the various coal companies, for the first and third weeks in June, has apparently given increased confidence to the trade, and is, I think, the strongest assurance possible of the permanency of the arrangements made for the season of 1884.

It is quite natural that buyers should hold aloof during the month of May—and some of them may be disposed (as I stated last week) to substitute bituminous for anthracite—especially for manufacturing purposes; but the demand for domestic use is so large and constantly increasing, for the Western trade in particular, that miners feel no apprehension that the output will be materially decreased this year.

It is estimated that 150 children are daily employed in what is called "the juvenile coal trade" at this port. They gather up the pieces of coal under and around the cars, trestles, etc., and many tons in the aggregate are thus collected. To describe the ingenious ways by which extra coal is obtained from loaded cars would fill one of your columns. Hundreds of tons of coal are said to be appropriated in small lots during the year by these children and their parents. It is a rare thing to catch the delinquents in their pecculations, they are so very cunning. Steps have been taken, in a mild way, to remedy this evil, but thus far no marked success has resulted.

The Tift farm works are so far completed that on Friday last a 250-ton vessel, loaded with lumber and drawing 11 feet of water, was towed into the new canal, thus practically uniting the Buffalo River with the new nine miles of water frontage of the Lehigh Valley Railroad Company.

The bituminous coal trade is without any new features in supply, demand, or prices.

The stock of coke is ample, and there is a fair demand. Connellsville is selling on the cars here at \$4.40 a ton.

I telegraphed you last Thursday that up freights had advanced 5c. a ton, but you did not publish the news. Shippers did not like to accede to the demands of vessel men; but as tonnage was scarce and inquiry good, they were obliged to pay the advance.

Shipments westward from Buffalo May 22d to 27th, both days inclusive, 29,360 tons, namely, 14,300 tons to Chicago, 2280 to Racine, 4520 to Milwaukee, 3110 to Toledo, 5010 to Duluth, and 140 to Sandusky.

Freight engagements were at the following rates: To Chicago and Milwaukee, 80c.; to Duluth, 85c., 80c. and on contract; to Racine, 90c.; to Toledo and Sandusky, 40c.; to Marquette, 80c., and to Saginaw, 50c.; to Port Arthur the rate was about \$1, closing firm for all points.

Receipts here by Lake Shore & Michigan Southern Railroad for the past week were 840 tons, namely, 588 tons to Buffalo, and 252 tons for other points.

Canal shipments Eastward were as follows: 1 boatload to Falton, 80c. net ton, and 1 boatload to Syracuse, 80c. gross ton, free on dock. Yesterday, 1 boatload to Schenectady, and 1 load to Port Jackson, 90c. gross ton, also 1 load to Palmyra, 60c. gross ton, all free on dock. The nominal rates to New York, \$1.35 @ \$1.40, and to Albany \$1.10 per gross ton, captain to pay unloading.

Messrs. Bell, Lewis & Yates are preparing new docks here with capacity for loading 1000 tons coal daily to vessels. The docks will be completed next week, and will be used chiefly for Port Arthur freight. The Buffalo Creek Railroad tracks run directly to the wharf.

By the bye, the suspension days from mining last year aggregated 67. This item is suggestive.

The receipts of coal at Chicago from the opening of navigation to May 20th were as follows:

	Tons.
From Buffalo, anthracite	43,454
From Cleveland, bituminous	16,598
From Erie, anthracite and bituminous	3,469
From Oswego, anthracite	570
From Charlotte, anthracite	1,888

Total..... 65,979

The receipts of coal at Duluth from the opening of navigation to May 23d inclusive, I find, from an examination of the port list, to be 36,990 tons.

The shipments of coal to Detroit from Buffalo thus far this season have been small. Railroad competition, with cheap rates, has proved too strong a factor in the carrying trade thus far.

Have you seen the following paragraph: "The contract for carrying the coal and iron of the Thomas Iron Company has been transferred from the Lackawanna to the Lehigh Valley Railroad Company; better rates have been secured. The business amounted to \$400,000 a year to the Lackawanna. The Iron Company saves over \$100,000 a year by the change."

Lake captains from Lake Superior report "that from Whitefish Point to Marquette, a distance of 100 miles, there is almost a solid field of ice, which extends from the shore 15 miles into the lake." A contrast to your reports of extreme heat, sunstrokes, etc.

Marquette is said to be suffering from a coal famine; vessels are detained there in consequence of the scarcity of fuel.

Boston. May 28.

[From our Special Correspondent.]

Retailers of coal in this market, like retailers of all other commodities, are allowing first hands to carry the stock and are ordering merely as they need. Large consumers are doing the same thing. Hence it is that we chronicle a continued state of dullness. Jobbing quotations of anthracite are practically unchanged. The stock is lightest of free-burning stove and special coals of all kinds. There is an abundance of broken and egg to be had at greater concessions than can be had on other sizes. At New York, f. o. b. prices are \$4 for Stove; \$3.65 for Broken and Egg; and \$3.85 for Nut. Philadelphia f. o. b. prices are \$3.75 @ \$3.85 for Stove, and \$3.40 for Broken and Egg. But little nut size is sold. Lykens Valley is worth at Philadelphia, for Stove, \$5.50; Egg, \$4.90. Shamokin Stove is selling at \$4.15; Egg, \$3.90. These figures represent the range in the various special coals which Philadelphia and New York are constantly pressing.

The market for bituminous coal can hardly be said to have improved. Notwithstanding the claims that

best Cumberland is not selling at such low figures as we have quoted, for cargo lots, any fair-sized contract for either Cumberland or Clearfield would be taken at practically no change from the lowest quotations that have prevailed. Cargo lots, delivered, are worth \$3.90 @ \$4 a ton. It is interesting to note the concentration of business at Baltimore this year. As the result of the lowered rates of the Baltimore & Ohio Railroad, there have been no shipments to this port of any account from Georgetown or Alexandria. In the first four months of 1883, 13,000 tons were received here from Georgetown, and 800 tons from Alexandria. Now, in 1884, only 4800 tons have come along, all of which is from Alexandria. Georgetown has sent no coal to Boston this year. Gas-coal is moving slowly at unchanged low prices.

From the provinces, 7000 tons have been received. Last year at this time, 18,600 tons had been received.

There is an easier feeling in freights, noting charters at New York as low as 90 cents, and at Philadelphia at \$1.25 per ton. Such low rates put a damper on barge business. A few barges have run as an experiment from Philadelphia to Providence and ports on the south side of the Cape, for \$1. We quote:

New York, 90c. @ \$1.15 per ton; Philadelphia, \$1.25 @ \$1.30; Baltimore, \$1.40; Georgetown, \$1.40; Newport News, \$1.25; Richmond, \$1.80; Bay of Fundy, \$1.50; Cape Breton, \$1.90 @ \$2.

Retail prices are nominally unchanged from our quotations, but no dealer is disposed to lose a customer if a concession will save him; so that, although some are getting \$6 for stove coal, the trade generally are cutting, and the extremely low prices on the wharf continue openly. It is claimed that such coal is not first quality; but parties who can use it would do well to lay in a stock. Not much is done in any quarter, however. Meantime, the struggle for tonnage on the part of one dealer continues the disturbing element, with no prospect of speedy termination. We quote:

White ash, furnace, and egg	\$5.50 @
stove and nut	5.75 @
Red ash, egg	6.00 @
stove	6.00 @
Lorberry, egg and stove	6.50 @
Franklin, egg and stove	7.25 @
Lehigh, furnace, egg, and stove	5.50 @ 5.75
nut	5.50 @ 5.75

Baltimore. May 28.
[Specially Reported.]

Trade during May has been somewhat unsettled. Dealers are generally buying sparingly, not having full confidence in prices. Hard white ash and free-burning have been in good supply, but Lykens Valley is coming in slowly by water.

There is a better feeling since it has become known that restriction will be adhered to for two full weeks next month, though it may give us a short supply of free-burning coals.

Consumers are late this year in making inquiries for coal in large lots. Soon after the 1st proximo, however, it is expected that the trade will move. The large city and other contracts will then be taken and business for the season commence.

Prices, both wholesale and retail, are about the same as last year, except Lykens Valley, which is higher, especially stove size.

There is not as much life in the trade as we should like to see. This is due, no doubt, to the general feeling of timidity pervading all branches of trade, especially manufacturing industries. ANTHRAC.

STATISTICS OF COAL PRODUCTION.

Comparative Statement of the Transportation of Coke over the Pennsylvania Railroad for the week ended May 24th, and year from January 1st:

	—1884—		—1883—	
	Week.	Year.	Week.	Year.
Gallitzin & Mountain (Alleghany Region).....	2,549	52,966	1,090	47,190
West Penn. RR.....	132	24,464	3,153	43,020
Southwest Penn. RR.....	47,877	883,929	40,640	799,637
Penn. & Westmoreland Region, Pa. RR.....	4,774	70,050	3,592	96,740
Monongahela, Penn. RR.....	1,654	32,360		
Pittsburg Region, Pa. RR.....		136		313
Snow Shoe (Clearfield Region).....	198	8,307	444	8,072
Total.....	57,182	1,072,212	48,928	995,172
Increase.....		77,040		

Comparative statement of the production of anthracite coal for the week ended May 24th, and year from January 1st:

	1884.		1883.	
	Week.	Year.	Week.	Year.
Wyoming Region.				
D. & H. Canal Co.	55,608	1,369,691	49,201	1,354,746
D. L. & W. RR. Co.	109,330	1,759,550	89,147	1,719,606
Penna. Coal Co.	19,071	419,951	22,375	471,259
L. V. RR. Co.	21,903	491,549	8,738	404,970
P. & N. Y. RR. Co.	4,778	75,005	2,803	74,918
C. R. R. of N. J.			50,978	928,210
Penn. Canal Co.		68,471	13,148	93,137
North & West Br. RR.	16,334	311,930	5,964	188,021
Total.....	226,924	4,396,094	242,254	5,232,865
Lehigh Region.				
L. V. RR. Co.	65,983	1,602,482	63,847	1,782,397
C. R. R. of N. J.			48,549	849,008
S. H. & W. B. RR.	3,273	78,621	2,064	18,635
Total.....	69,256	1,681,103	114,460	2,650,060
Schuylkill Region.				
P. & R. RR. Co.	194,098	3,783,698	101,461	2,482,383
Shamokin & Lykens Val.			23,817	506,837
Total.....	194,098	3,783,698	125,278	2,989,220
Sullivan Region.				
St. Line & Sul. RR. Co.	2,194	31,786	1,158	23,746
Total.....	492,472	9,892,681	483,150	10,595,891
Increase.....				
Decrease.....		1,003,210		

* Included in tonnage of the Philadelphia & Reading Railroad.

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

Total same time in 1879.....	5,325,681 tons.
" " " " 1880.....	9,299,850 "
" " " " 1881.....	9,693,057 "
" " " " 1882.....	9,520,085 "

The increase in shipments of Cumberland Coal over the Cumberland Branch and Cumberland & Pennsylvania railroads amounts to 87,729 tons, as compared with the corresponding period in 1883.

Belvidere-Delaware Railroad Report for the week ended May 24th:

	Week.	Year.	Year.
	1884.	1884.	1883.
Coal for shipment at Coal Port (Trenton).....	1,538	19,386	28,391
Coal for shipment at South Amboy.....	13,990	256,919	329,379
Coal for distribution.....	14,110	308,529	313,800
Coal for company's use.....	4,316	72,467	58,109
Total.....	33,944	657,301	729,679
Increase.....			
Decrease.....		72,378	

Comparative Statement of the Production of Bituminous Coal for the week ended May 24th and year from January 1st:

Tons of 2000 pounds, unless otherwise designated.

	—1884—		—1883—	
	Week.	Year.	Week.	Year.
Cumberland Region, Md.				
Tons of 2240 lbs.	68,647	963,208	52,582	837,424
Barclay Region, Pa.				
Barclay RR., tons of 2240 lbs.	6,027	139,829	4,645	135,042
Broad Top Region, Pa.				
Huntington & Broad Top RR., of 2240 lbs.	3,344	77,020	3,329	82,617
Clearfield Region, Pa.				
Snow Shoe.....	1,949	77,404	4,050	100,709
Karthus (Keating).....	1,578	6,157		
Tyrone & Clearfield.....	70,974	1,198,167	48,881	1,106,719
Alleghany Region, Pa.				
Gallitzin & Mountain.....	6,215	148,975	8,262	191,836
Pittsburg Region, Pa.				
West Penn RR.....	4,841	117,275	12,399	193,885
Southwest Penn. RR.....	3,008	66,046	1,322	47,893
Pennsylvania RR.....	8,673	113,530	8,899	193,886
Westmoreland Region, Pa.				
Pennsylvania RR.....	26,442	451,393	28,182	557,178
Monongahela Region, Pa.				
Pennsylvania RR.....	1,947	63,680		
Total.....	198,645	3,422,584	162,451	3,446,989
Decrease.....		24,405		

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