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\*Illustrated.

### CONSOLIDATION.

Beginning with this issue, the semi-monthly publication, *Mining and Metallurgy*, has been merged with the *ENGINEERING AND MINING JOURNAL*. By concentrating on one journal, the efforts heretofore put upon the two, it is confidently believed that the value of the publication to its readers will be very largely enhanced.

Mr. W. J. Johnston, the well-known publisher, has acquired large holdings in the company, and has been elected its president. Mr. James H. McGraw, former President, will continue as a member of the board of directors. There will be no change in the editorial staff or business department. More branch offices will, however, be established, together with a more extensive system for collecting the news relating to mining and metallurgical progress the world over.

The *ENGINEERING AND MINING JOURNAL* has long been recognized as the authoritative journal of the important industry which it represents, and while no changes are contemplated, no effort nor expense will be spared to strengthen the paper in all its departments and make it indispensable to everyone in the mining field.



WE HAVE to congratulate our readers once more upon the completion of a year of prosperity and progress, which we may almost say has been unexampled in the history of the mining industry in the United States. We wish them also the fullest possible continuance of this prosperity during the year 1892 and trust that at the conclusion of the year just opened we may again be able to record a substantial advance.



THE COLLAPSE of the asphalt bubble, which was brought about by the appointment of three receivers for the National Asphalt Company last Saturday, seems to have occasioned no surprise, nor to have created any disturbance. The event had been well discounted in advance. It was a flagrant example of stock watering, which came to its proper end. Its management, outside of the watering feature, seems also to have been characterized by poor judgment, if not more serious faults. Fortunately, this failure came in a season of plenty, when most people can afford the loss.



### IN MEMORY OF CLARENCE KING.

We publish elsewhere in this issue a tribute to the memory of Clarence King, by his life-long friend, Prof. S. F. Emmons, of the United States Geological Survey. The announcement of Mr. King's death and a brief sketch of his career were given in last week's issue of the *JOURNAL*. The funeral services were held in this city, Wednesday morning, January 1, and were largely attended by scientific men, among whom he was held in the highest esteem. In his death geological science has lost one of its sincerest devotees. He was the organizer and first director of the United States Geological Survey, now one of the most useful branches of the government's scientific work, representing and promoting, as it does, the interests of the mining industry.

Mr. King's greatest contribution to geology was in securing important appropriations for geological work from the United States Government and then bravely directing this to definite problems of min-

ing geology, where quantitative results of unprecedented accuracy were necessary to success. In this his enthusiasm and inspiring personality succeeded in gathering the greatest mining geology to his support, and the united efforts of this corps gave results which have become classic in mining geology and would have long been delayed without his leadership.

A meeting of the officials of the Geological Survey was held in the office of that Bureau in Washington on Saturday, December 28, at which appropriate resolutions, printed in full elsewhere, were passed.



### THE YEAR 1901

In the following pages we present, according to our usual custom, a review of the progress of the mining and metallurgical industries in the United States during the year which has just closed. With the aid of our correspondents and contributors we have endeavored to make this as complete as possible at this early date, and we believe that our readers will be able to form a correct idea of what has been accomplished during the first year of the twentieth century. We are gratified in being able to say that upon the whole it has been a year of substantial progress; and while some things have been left undone and perhaps some mistakes have been made, the great interests which the *JOURNAL* represents and aims to serve are in even stronger and more prosperous condition than they were a year ago.

In a summary which covers so wide a field and in which so many different points must necessarily be considered, it is not easy to dwell at any length or with particular emphasis upon any single point, and we must endeavor simply to give our readers a general idea in the briefest possible space.

Perhaps the most important feature in our mineral production is the fuel upon which the prosperity and progress of our mining industries—and in fact of all other industries—depends. In this respect we have again to record substantial progress and to say that the enormous output recorded in 1900 has again been exceeded, and that when the complete statistics are collected they will show that last year we mined very nearly 300,000,000 short tons of coal, an amount considerably in excess of that produced in Great Britain, and very far beyond the quantity which any other nation in the world can show. Nearly all of this enormous amount was consumed within our own borders, the coal which we export forming an insignificant portion of the total, in spite of the increase in exports during the past two years. The details of the course of coal production and of the condition of the fuel markets are fully shown in the review given in the following pages. About one-fifth of the production is the anthracite coal of Pennsylvania, which not so many years ago constituted the more important part of our fuel supply. The growth of the country, the development of the extensive bituminous coal-fields and improved methods in iron making have in recent years developed enormously the mining and consumption of bituminous coal. The soft coal of Pennsylvania, West Virginia, Ohio, Illinois, Indiana and other Western States, not only supplies the household fuel of the Central and Western States, but has also to a very great extent replaced anthracite in the furnaces, mills and factories of that section of the country in which it formerly had an exclusive field—New England, the Atlantic Seaboard States, and the States of the Ohio Valley. Bituminous coal and coke are now the steam producing and

metallurgical fuels of the entire country and anthracite is coming each year to depend more largely upon domestic or household demand in the Eastern States. In all the region west of Buffalo and Pittsburg anthracite, owing to the cost of transportation, may be regarded as to some degree a luxury and its consumption is confined to the larger cities. The smaller sizes of anthracite, which until a very few years ago went principally into the culm heaps at the mines, but which are now carefully saved, form the only portion of this fuel which is largely used in manufacturing, and even the use of these is confined in great measure to cities like New York and Boston, where the burning of bituminous coal is forbidden by local ordinances. We may regard it as a fixed fact, therefore, that the growth of anthracite traffic will depend hereafter on the growth of population, the only other marked influence on the trade being exerted by the weather conditions—a cold winter increasing and a mild one decreasing the demand.

In coke there is little to note during the past year except the fact that the production and consumption have been greater than ever before, chiefly on account of the activity of the iron trade. The extensive working of the Connellsville field, which is still the chief coke producing district, has led coke makers and steel companies to make provisions for the possible exhaustion of the supply and to close extensive purchases of coal lands in West Virginia and elsewhere where good coking coals are to be found. The use of the by-product coke oven has made some advance during the year and the progress made is suggestive of still more rapid growth in the future.

Closely allied to the coal question is the use of oil as fuel. The discoveries in California during the past few years have led to the extensive use of crude petroleum and petroleum residues as fuel on the Pacific Coast to an extent which is seriously affecting the coal consumption of that section. It is also proving an important stimulus to manufacturing in California, which has hitherto been hampered by the comparatively high cost of fuel, which to a large extent offset the advantage given to local factories by the high cost of transportation from the East.

Of far greater importance, however, than the comparatively moderate production of the California fields has been the discovery of oil in Texas, the somewhat sensational opening of the Lucas well, near Beaumont, in Texas, just at the close of 1900 marked the opening of an era of exploration and discovery which has revealed the existence of an oil field producing at a rate unexampled in the history of petroleum. The field has attracted operators from all over the country and from abroad and is being developed at an extraordinarily rapid rate. Its production of an oil especially adapted for fuel purposes will undoubtedly have a most marked effect on the coal trade of the southwest and perhaps of some other sections of the country. In fact, we may say that since the first discovery of petroleum in Pennsylvania and the opening of the great Russian oil fields around Baku, the discovery of this Texas field is the most important event which has occurred in the history of petroleum. The limits of the new field are not yet clearly defined, but there is no doubt that it is going to be a very large producer and that it must be taken into account in all forecasts of the coal and oil trades. The main point is that a most important development of the vast resources of Texas itself will be the immediate result.

The iron trade, which comes next in economical importance to our coal production, showed in 1901 a production which a few years ago would have been considered impossible. The quantity of pig iron made, which is the index to the output, was not only the largest which the United States has ever recorded, but it equalled that of Germany and Great Britain

together. The production of raw iron, steel and finished products of all kinds showed an increase parallel with that of pig iron. Moreover, even this enormous output was not in excess of the demand and at the close of the year the great furnaces and mills, almost without exception, were behind in their orders and were making every effort to keep up their deliveries in accordance with contracts, but not in all cases with success. There is every prospect, also, that this condition of affairs will continue throughout 1902, as all the great companies have their full capacity engaged for at least the first half of the year.

The production of so great an amount of iron required the mining and handling of a corresponding quantity of iron ore. The shipments from the Lake Superior region alone exceeded 20,000,000 tons. This enormous business was handled by water with only some slight delays, which were caused entirely by the insufficient capacity of the docks at the Lake Erie ports, and the delay of the railroads in moving ore from those docks. This business furnished another striking illustration of the advantages enjoyed where water transportation can be had.

Export business in iron and steel showed a considerable falling off as compared with 1900. This was due in part to the depressed condition of business abroad and the smaller demand for iron and steel in Europe. In part also it resulted from the enormous home demand, which absorbed all that we could produce and left our manufacturers little opportunity to look for foreign business. It was even reported in December that some mills in the East unable to secure prompt delivery of steel billets had made purchases of German material for import.

Gold production for the year again recorded a substantial increase and probably reached an amount between \$82,000,000 and \$83,000,000. The increase came from almost all of our gold producing regions, although Colorado, California and the Black Hills contributed the greater part of it. The development of the far northern regions of Alaska has been impeded by various causes, and the production of that territory shows only a moderate gain. One feature of the year in gold production has been the increased working of low-grade ores and the greater use of the cyanide process. Improvements in treatment, closer working and the reduction in costs of mining and milling have all assisted in improving the position of the gold mining industry. Another feature has been the introduction of an extensive scale of dredging machinery into California for working low-grade placer deposits.

Our silver production remained about the same in 1900 as in 1901. There was little change in the quantities obtained from ores worked for silver values alone and from those ores from which silver is won in connection with lead and copper. As usual, the mines of the Cœur d'Alene, in Idaho, and of the Leadville and San Juan districts, in Colorado, contributed the larger share of the silver-lead production, while the copper mines of Butte and Arizona furnished the copper-silver ores.

Copper production last year was somewhat less than in 1900; the falling off amounted probably to 2,500 tons. The decrease was most marked in the Butte District, in Montana, but some of the Arizona mines also failed to come up to the figures of the preceding year. The Lake Superior mines showed some increase, as did those of Utah and California, but they failed to make good the deficiency entirely. Much interest has centered in copper during the year, chiefly on account of the unusual market conditions, the history of which is given on another page. It is sufficient to say here that an attempt to maintain market prices at an abnormal level ended in failure and general disturbance of the business. It is to be hoped that the unholy alliance which has

been formed between copper and the speculative markets will be dissolved in the opening year and that the copper industry may resume its normal conditions.

In the metallurgy of copper and especially in electrolytic refining we continue to maintain our leadership. Our works not only refine the copper made in this country and nearly all of that produced by Mexico and Canada, but were able during the past year to take the contract for refining the blister copper from the smelting works of the great Mount Lyell mines in Tasmania, notwithstanding the strong competition of the Swansea refiners. Copper from South America is also coming here in increasing quantities, and it seems not improbable that before long we may treat the production of Chile and Peru in addition to that which we already handle.

In lead production in 1901 there was some decrease. The output of argentiferous lead fell off about 20,000 tons, as compared with that of 1900, while there was an increase of about 10,000 tons in the production of soft lead carrying no silver, chiefly from the Missouri mines. The total decrease of about 10,000 tons left our production as still in advance of the consumption, especially when taken in connection with the unusually large stocks carried over from the preceding year. The falling off in demand in the European market and the consequent reduction of prices abroad compelled a decrease in our own prices in the latter part of the year and left the market in a somewhat unsatisfactory condition.

Zinc production showed an increase over that of 1900. The chief features of the year were the prosperity of the Joplin Region in Missouri and the advances made in the metallurgical treatment of zinc ores, which is fully treated on another page. The consumption of spelter appears to have kept fully up with the production. Exports of the metal, however, which had attained considerable proportions, fell off very heavily last year, owing to the depressed market conditions abroad; although a considerable quantity of zinc ores was exported to Germany and Belgium.

In the metals of minor importance, such as quicksilver, nickel, etc., satisfactory records were made; while we continue to turn out a considerable portion of the nickel supply of the world, it is refined in the United States mainly from Canadian ores, and the production from United States ores mined in the United States is very small. Prospecting for nickel has continued, however, and there are promises of a larger production in the future. An incident of some importance in the nickel trade is that the United States Steel Corporation has apparently decided to control the supplies of this metal required for making nickel steel and to that end has recently gained control of the nickel corporation, an English company which has valuable possessions in New Caledonia.

The chemical industries of the United States, which are based largely upon its production of salt, bauxite, borax and other minerals, made satisfactory progress during 1901. This has been especially the case with the companies manufacturing heavy chemicals, bleaching powder, etc., from salt, which have been recently established near the great salt deposits of Michigan and at Niagara Falls, in the one case seeking cheap supplies of the raw material and in the other the cheap power which is so essential in electrolytic processes.

In the great field of non-metallic minerals, including such important products as cement, building stone, the various articles manufactured from clay, and the like, the year has been a prosperous one. The general abundance of money and the activity of trade has made building operations of all kinds very active and created a great demand for all the materials of construction, both metallic and non-metallic, with corresponding advantage to the producers.



TRIBUTES TO CLARENCE KING.

In last week's issue of the ENGINEERING AND MINING JOURNAL announcement was made of the death of Clarence King, one of America's foremost geologists. This was accompanied by a brief and hurriedly prepared sketch of his career. We give below a tribute to his memory by his intimate friend, Prof. S. F. Emmons, through whose courtesy we are also able to publish the accompanying portrait of Mr. King. The funeral took place in this city Wednesday morning, January 1.

A meeting was held in the office of the United States Geological Survey, at Washington, on Saturday, December 28, to express the profound sorrow of the scientific men of the Bureau at the death of Mr. King, the organizer and first director of the Survey. Addresses were made by Major J. W. Powell, Hon. Charles D. Walcott, and Prof. S. F. Emmons. The following resolutions offered by Major Powell and seconded by Mr. Hague were unanimously adopted as an expression of their great loss in the death of so eminent a leader of geological science:

"It is with profound sorrow that we learn of the death of Clarence King, the first director and, in a sense, the founder of the Geological Survey. In him we have lost not only a great scientific leader, but a genial and accomplished gentleman, whose personal qualities endeared him to all who knew him, and whose many acts of loving kindness have left a wide circle of friends in all walks of life to mourn his untimely death.

"As organizer and, during ten years, Chief of the United States Geological Exploration of the Fortieth Parallel, he set higher standards for geological work in the United States and laid the foundation of a systematic survey of the country. He gave practical recognition to the fact that a good topographical map is the essential basis for accurate geological work.

"As first director of the present Geological Survey, he laid down the broad general lines upon which its work should be conducted and which, as followed by his able successors, have led to its present development. He established the principle that a Geological Survey of the United States should be distinguished among similar organizations by the prominence given to the direct application of scientific results to the development of its mineral wealth.

"In that essential quality of an investigator—scientific imagination—no one surpassed King, and his colleagues have all profited by his suggestiveness. He was never content, with the study of science as he found it, but always sought to raise the standard of geology as well as to apply known principles to the survey of the country.

"King first introduced microscopical petrography into American geology and, as early as his Fortieth Parallel work, he foreshadowed the application of exact physics to questions of geological dynamics. Early in the history of the present Survey he established a physical laboratory. One result of this step was a paper on the Age of the Earth, which takes very high rank among modern scientific memoirs. Although in his last years circumstances rendered it necessary for him to devote most of his time to other occupations, he had by no means abandoned plans for geological investigation on a scale worthy of his reputation.

"In Clarence King geological science in America will miss a pioneer and a leader; the Geological Survey loses its broad-minded founder and adviser, and its older members a beloved friend."

THE LIFE AND SCIENTIFIC WORK OF CLARENCE KING.

Among the many who have met Clarence King, there were few but have borne away from their meeting a delightful impression of the subtle charm of his personality. Of those in the most varied walks of life, scientific, literary and artistic, who have been counted his friends, each has recognized in him, in addition to this charming personality, a wonderful grasp of mind and a clear insight into the essential principles of his own particular profession. To the members of his small circle of intimates alone has it been sometimes permitted to gain a knowledge of the great and tender heart which accompanied this remarkable intellectual development, but the recipients of his beneficence, whether of mind or purse, alone can realize with what grace and freedom he gave.

No one man could ever do justice to all his varied accomplishments, for there was nothing that he touched, whether in art, literature or science, that he did not adorn. Doubtless many casual

er, a woman of most remarkable intellectual gifts, who, left a widow while still in her teens, had devoted her life to the education of this, her only son. His professional education was completed at the Sheffield Scientific School of Yale, which he left in 1862, a member of the first class that received a degree from that institution. At college he was devoted to athletic sports, and throughout all his life was distinguished for remarkable physical vigor and energy; even up to the time of his last illness he was in the habit of enduring fatigues that would have worn out men of half his years.

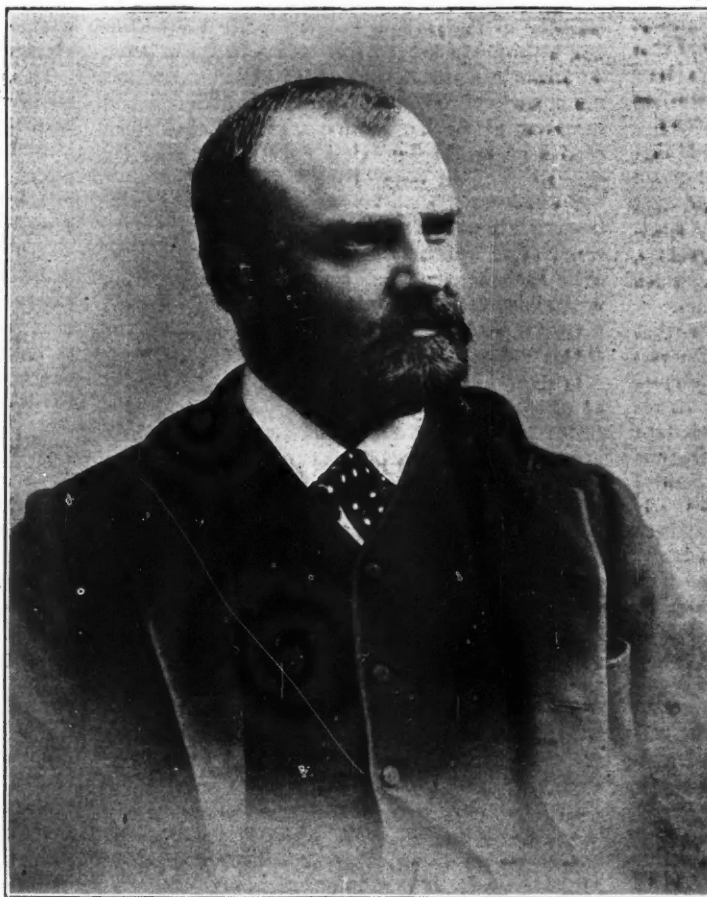
Immediately upon graduation he set out on a horseback trip across the continent in order to study the then practically unknown Rocky Mountains, or Cordilleran System. This trip, which he and his friend, James T. Gardner, made with an emigrant train, starting from St. Joe, Missouri, occupied several months, during which he first conceived the idea of the importance and feasibility of making a geological section across this, the longest mountain system in the world, at its widest point, an idea which he succeeded in putting into practical execution five years later.

Such a trip in those days was necessarily full of incident, but space will only admit of the mention of a single one: The young explorers had left their emigrant train and stopped over at Virginia City to study the already famous Comstock Lode. The night after their arrival the boardinghouse in which they were sleeping caught fire, and King, who was a sound sleeper, barely escaped with his life, losing everything he had with him. His loss included not only his clothing, but all his letters of credit and recommendation, and he was, therefore, obliged to go to work as an ordinary hand in one of the mills in order to earn money enough to continue his journey, for in those days it was a question of months, rather than days, before replies could be had to mail communications with the East.

When he finally reached California, after crossing the Sierras on foot, he attached himself as volunteer assistant to the Geological Survey of the State of California, under Prof. J. D. Whitney. Among his scientific services on this Survey were the first determination of the age of the auriferous slates, the exploration of the Mt. Whitney group of the Southern Sierras, then the highest known mountain mass in the United States, and the recognition of the glaciation of the Sierras, which his chief had, up to that time, not believed in. He was also associated in the examination of the mines of the Mariposa Grant and took part in an exploration of Arizona under General McDowell. During the

latter, he and his companion were once captured by the Apaches, but were fortunately rescued just as the fires were being prepared for their torture.

After the close of the Civil War, when Congress, as a measure of wise public policy, had voted to subsidize the Trans-Continental railroads, King recognized that the time had come for carrying out his scheme of connecting the geology of the East with that of the West, and making a cross-section of the entire Cordilleran System. In the winter of 1866-7, he went to Washington, and in spite of the disadvantage of his youth, and still more youthful appearance, he was so successful in impressing Congress with the importance of ascertaining the character of the mineral resources of the country about to be opened up by these railroads and affording a scientific basis for their development, that, not only was a generous annual appropriation voted for the geological exploration he had planned, but King himself was placed in absolute charge of it, subject



CLARENCE KING.

acquaintances have reasoned that one who could be brilliant in so many different lines could not have been thorough in all, and probably few, even among mining engineers, realized to what extent the present remarkable development of our mining industry is due, directly or indirectly, to the labors or influence of Clarence King. Since therefore, in a hasty sketch like the present, it would be manifestly impossible to do justice to all the phases of his many sided life, it will only be attempted to trace that which had to do with mining industry.

According to the standards of the present day, King did not receive a very elaborate professional training; but, together with an instinctive faculty of grasping at once the key-note of any subject he was studying, which is generally considered characteristic of genius, he possessed the more unusual power of concentration of mind that enabled him in comparatively brief time to master all the essential details of his subject.

In his early life the bent of his mind toward the study of nature was greatly influenced by his moth-

only to the administrative control of General A. A. Humphreys, Chief of Engineers.

It was characteristic of the scientific thoroughness of the man that, while all similar works under government auspices were called *surveys*, this, the only one which formed a systematic whole and constructed complete topographic maps of the area examined, was designated by him simply an *exploration*.

The most important result of this work, in its relation to mining, was the publication in 1870 of the economic bearing of its results in the volume by King and Hague, entitled "Mining Industry," a work which marked a new departure in geological reports. It was well characterized in these columns as "by itself a scientific manual of American precious metal mining and metallurgy, and an invaluable work of reference concerning the mode of occurrence of gold and silver." It was mainly devoted to an exhaustive study of the Comstock Lode, the mining regions farther east having reached at that time but a very limited development. In the Comstock mines alone had mining methods and machinery made any distinct advance over European precedents. These advances were all illustrated by drawings made to scale with such accuracy that it is said that the well-known firm of Frazer & Chalmers later used them as working drawings in the construction of their early stamp mills and hoisting machinery.

The original plan of the exploration had contemplated only three years' field work, and it was a striking tribute to King's ability as its chief, that Congress, in the summer of 1870, without any solicitation on his part, and, indeed without his knowledge, made an appropriation for its continuance, which extended its field work for another three years.

In consequence of this extension and the time required by various specialists to work up the vast amount of material gathered, ten years had elapsed ere the six quarto volumes, which embodies its results, were completed, and King was able to undertake the final summing up of the whole. This work was published in 1878 as a volume of 803 pages, entitled "Systematic Geology." Probably no more masterly summary of the great truths of geology had been made since the publication of Lyell's "Principles," and it differs from the latter in that it is not a compilation, but based on personal, or personally directed, observations. It was well characterized by one of its more careful reviewers in the following terms: "The most satisfactory part of Mr. King's work, next to its scientific thoroughness, is the breadth of view which embraces in one field the correlation of such extended forces and the vigor of grasp with which the author handles so large a subject without allowing himself to be crushed by details. Hitherto every geological report has been a geological itinerary without generalization or arrangement. This volume is much more; it is, indeed, almost a systematic geology in itself and might be printed in cheaper form and used as a textbook in the technological schools."

King's crowning service to geological science in this country, and through it, to the development of mining industry, followed shortly after the completion of the Fortieth Parallel work in the conciliation of the warring elements in existing government surveys, which seriously threatened to put a stop to all government aid to scientific work. Probably few realize that it was mainly through his influence among the leading scientific men of the country, and his tactful management of affairs in Congress, that this crisis was averted. The question was referred to the National Academy of Sciences, and their recommendations, which were on lines laid down by him, were finally adopted by Congress, and early in 1879 a law was passed establishing the United States Geological Survey as a Bureau of the Interior Department. King was appointed Director of this Survey by President Hayes, with the approval of the chiefs of all the organizations which it displaced.

Although, owing to failing health, consequent upon the severe strain, both mental and physical, of nearly 20 years' strenuous work, he felt obliged to retire to

private life in the second year of his directorship, he maintained the liveliest interest in the work and organization of the Survey up to the very last. In the short period of his administration he outlined the broad general principles upon which its work should be conducted, and its subsequent successes have been in great measure dependent upon the faithfulness by which these principles have been followed by his successors. His belief was that a geological survey of a great industrial country, while not neglecting the more purely scientific side of its work, should occupy itself primarily with the direct application of geological results to the development of the mineral resources of the country.

Under his direction were carried on the examination of the Comstock, Eureka, Leadville, and other mining districts, whose importance is to be measured not solely by the accurate information which they afforded of these particular regions, but in far greater degree by their influence upon a whole body of mining engineers, in teaching them the practical importance of a study of the geological relations of ore deposits.

He also planned and supervised the collection of statistics of the precious metals for the Tenth Census, a work which has never been equalled in detail or scientific accuracy, and whose logical result was the annual collection of statistics of all the mineral resources of the United States, which has been carried on by the Geological Survey ever since the completion of the work of the Tenth Census.

While it was his work as an organizer and administrator that will have the most far reaching results, results that will endure when the memory of him shall have become dim, his personal influence in maintaining high standards of scientific accuracy and personal integrity in the mining profession was always most potent.

In the case of the exposure of the diamond fraud of 1872, the credit of the discovery of its long concealed location was due to his assistants who happened to have surveyed during the previous summer the region within which it was included. It was in the interest of pure science, and in the hope of discovering the true matrix of the diamond, that he undertook its investigation. When it was discovered that the ground had been salted, it was King's prompt action that averted the financial catastrophe that threatened to involve Europe, as well as this country. By traveling day and night, he outstripped all other possible means of information, and on reaching San Francisco, made a peremptory demand upon the directors of the company that they should at once publish his discovery and stop all issue of stock. To a suggestion that the announcement should be temporarily delayed, he replied: "There is not money enough in the banks of California to induce me to delay this announcement a single hour." It was in San Francisco, where the company had started, and its stock was mainly held, that the importance of this discovery was best appreciated. With regard to it, the Reverend Horatio Stebbins made the following significant utterance: "One scientific man, whose untarnished fame alone is worth all the diamonds in the world, has found occasion to prove to the world the value of science and his own great moral worth; and that result alone compensates for all the shame of this great fraud. This man, in response to the promptings of duty and responsibility as the geologist-in-charge of the territory where the diamond field was alleged to be located, sought out the scene of the fraud in the service of science alone and hastened with his undeniable proofs to those engaged in forwarding the scheme and put an end to the projected robbery of the people. To have learned that we have one such man is enough to make us look upon the whole stupendous wrong and its results as a cause of thankfulness."

In the course of his long and varied career, King served as expert in many famous mining law suits, such as the Richmond-Eureka case in Nevada, the Dives-Pelican in Colorado, the Center Star-Iron Mask in British Columbia, and the Anaconda, and

other mines, in Butte, Montana, but he was never willing to accept a retainer in such service until he had satisfied himself by personal observation that the contention of the side that desired his services was in accord with his reading of the geological structure and such as he could conscientiously subscribe to. There have been cases where the entire line of argument has been changed after the inception of the case in deference to his opinion of its geological untenability.

He possessed not only a keen insight into geological structure, as developed in the underground workings of mines, that is rare, even among the best and most experienced geologists, but also a remarkable grasp of its legal bearing, so that to him was commonly allotted the general conduct of the case and the determination of the line of attack or defense to be followed. This, however, did not satisfy his conception of his duty toward his client, for he was never willing to trust to the observations of another, but always verified every fact in detail by his own personal inspection. He thus obtained such thorough knowledge of his subject that the most skillful lawyers in the profession were unable to shake his testimony by their cross-examinations, which often extended over several days' time.

This class of work was, however, to King a matter of necessity rather than of predilection, although he took pleasure in it, as he did in everything that involved a contest of wits and intellect. His first preference was for investigation in pure science, and to contribute in this line permanent and substantial additions to the foundations of human knowledge was his highest ambition; in literature and art he delighted, as a mental recreation and pastime, but money-making was to him merely a means to an end; necessary, but of relatively subordinate importance. That circumstances necessitated the devotion of so much of his time to the latter occupation has been a material loss to the world of science and art.

During his directorship of the Geological Survey he established a laboratory of experimental physics, defraying the expense of its costly apparatus out of his own pocket, and securing for its conduct the services of the most prominent young physicists of the day. Here were carried on under him a series of investigations into the Constants of Nature, with a view of testing experimentally, and, if necessary, revising the existing theories upon the constitution of the earth. The results of these investigations have already constituted important contributions to the science of terrestrial physics; King's paper on the "Age of the Earth," in the *American Journal*, has been characterized by such men as Kelvin and Helmholtz, as a most important contribution to the study of the earth. The final summing up of a new theory of the earth, though it had been formulated in his mind, was still awaiting the long-hoped-for moment of leisure when it was cut short by death. In literature, he had published but little, his principal work being "Mountaineering in the Sierra Nevada," a combination of scientific descriptions and genre-picturing which possesses literary merit equal to that of the best literary writers of the day.

In the spring of 1901, after an unusually arduous mining campaign, he had a severe attack of pneumonia and whooping cough, and during the convalescence it was discovered that he had contracted tuberculosis, the seeds of which were supposed to have been sown during a visit to the Klondike in the previous summer. From this disease he died at Phoenix, Arizona, on the 24th of December, 1901, in the 60th year of his age.

S. F. EMMONS.

Besides the publications mentioned above, the following scientific papers are credited to Clarence King:

"On the discovery of actual glaciers on the mountains of the Pacific Slope."—*American Journal of Science* 3d Ser. Vol. I, pp. 157-161, 1871.

"Paleozoic subdivisions of the Fortieth Parallel."—*American Journal of Science*, 3d Series, Vol. II, pages 475-482, 1876.



"Notes on the Uinta and Wahsatch Ranges."—*American Journal of Science*, 3d Series, Vol. II, page 494, 1876.

"Catastrophism and Evolution."—*American Naturalist*, Vol. II, pages 449-470, 1877.

"Report on Physical Constants of Rocks."—United States Geological Survey, *Third Annual Report*, pages 3-9, 1883.

"The Age of the Earth."—*American Journal of Science*, third series, Vol. XLV, pages 1-20, 1893. *Smithsonian Institution Annual Report*, 1892-93, pages 338-352.

#### GOLD AND SILVER IN 1901.

The year 1901 again showed an advance in the production of gold in almost all the parts of the world, although the South African mines are still restricted to a very limited output. The search for gold has continued everywhere active and has met with a considerable degree of success, although no such sensational discoveries as those of the Klondike rewarded the prospectors.

#### THE UNITED STATES

The gold production of the United States, which in the year 1900 amounted to \$78,159,674, in 1901 showed a considerable increase, the precise amount of which cannot yet be exactly indicated, although it is probable that our total exceeded \$81,000,000, and the final returns may carry it up beyond \$82,000,000. There has been everywhere intensified working of mines and improved treatment of ores, bringing into the market many low grade propositions, which a few years ago were not considered available for exploitation.

Colorado during 1901 fully maintained its position as the leading gold producing State in the Union. The output of Cripple Creek again showed a considerable increase, in spite of accidents in two or three of the important mines. The district, however, has fully maintained its reputation, and the reduction works have been hardly able to handle all the ores supplied to them from the active mines of the region. While no new mines have been added to the producing list, most of the old ones have done well, and in some cases, notably that of Stratton's Independence, have considerably exceeded the estimates made a year ago. In the Leadville District the gold belt has shown a remarkable gain, the details of which are given in the report of our local correspondent below. The old mining region of Gilpin County has worked steadily throughout the year, while the Tomboy and other mines at Telluride, and the gold mines in a number of less important districts throughout the State have fully maintained their record.

In California gold mining has made encouraging and steady progress, although there have been no new discoveries of importance. The work of developing old mines and of reopening other mines abandoned years ago has continued, in many cases with most favorable results. There has been some advance also in hydraulic mining, but no general resumption of operations in that direction, as the limitations of the Camminetti law prevented any important changes. The most striking new feature in California mining during the year was the use of the gold dredge in operating low-grade placer grounds. About Oroville, on the Trinity River, and in other districts, this method of exploitation is coming into extensive use. While these operations are still in the tentative stage, they are in large part conducted by experienced mining men and the dredge will be given a thorough trial. Should its success be proved this method of mining will undoubtedly add considerably to the California product.

In the Northern Rocky Mountain States, Montana and Idaho, gold mining has been fairly successful throughout the year and production has been well kept up, though without any remarkable increase. In Oregon, operations are being extended and much new capital brought into the State. In Washington alone conditions have not been favorable, the failure of the Republic District, from which so much was expected, having had a disastrous effect on the gold mining industry.

The Black Hills region in South Dakota made a notable advance during the year. The extended work of the Homestake Company is the most important feature, but the increased working of low-grade propositions has also been an important feature. The reduction of costs, due to improved transportation facilities, has had something to do with this, but a large factor is the enlarged use of the cyanide process, which has been found applicable to most of the ores of the Black Hills. This feature is especially treated in another part of this article.

The Utah production of gold showed a slight decrease in 1901, mainly from temporary causes, which will not affect mining during the current year. In New Mexico and Arizona there are no changes of importance to record. The attempt to reopen some of the old mines of Arizona, while successful in some cases, has been a failure in others, and the territory remains about where it was a year ago, so far as gold production is concerned.

In Alaska conditions have been varied. The Nome District is gradually passing through the preliminary period and settling down to steady work, although the evil influences of litigation and uncertainty as to claim ownership are still severely felt. Nevertheless, there was a considerable production of gold and an advance towards more systematic working of the gold deposits. Some gain was reported in the production from the Copper River and Tanana regions and there was an increased amount of gold from the American side of the Yukon Basin. Prospecting has continued along the shores of Behring Sea, in some cases with encouraging results, although the only immediate gain has been a small quantity of gold from the neighborhood of Golovin Bay. The great mines on Douglass Island continued steadily at work with about the usual results and there has also been some production from Sumdum and from the Ketchikan and the neighboring country.

In the South there has been little change, except in North Carolina, where gold mining has made an encouraging advance during the year, the results of which will be more apparent in 1902. The latest feature is the commencement of work on an extensive project for the utilization of the water power of the Yadkin and other rivers and its transmission electrically to a number of the mines of Western North Carolina. It is believed that in this way working costs can be decreased and success attained in many cases. In Georgia results have been of a varied nature. The consolidation of one group of old mines and the working of the ores in a large mill of modern design has proved so far a failure, chiefly on account of injudicious selection of machinery. Another consolidation which has been operated with more consideration for the special ores of the region and somewhat on the lines of the old Dahlonega method, is meeting with more success.

#### GOLD PRODUCTION OF THE WORLD.

In 1900 the gold production of the world reached a total of \$256,000,000. In 1901 this was undoubtedly exceeded, although the full amount of the increase cannot yet be stated with any approach of accuracy. We have referred above to the gain in the United States and give below some notes on the work done in the leading gold mining countries of the world during the year just closed.

*Australasia.*—Australasia, including the new Commonwealth of Australia and the Island of New Zealand, again takes second place as a gold producer. In a separate report below will be found a statement of the production for nine months of the year and the returns for the closing quarter will undoubtedly show very little change. The production will not vary very greatly from that of 1900, a considerable increase in Western Australia being offset by important losses in Queensland and New South Wales. New Zealand shows a considerable gain, chiefly from the mines of the Hauraki District. The famous gold dredging industry of the islands suffered a partial

collapse in the latter part of the year, but still contributed a considerable quantity to the total output.

*Canada.*—Canada, which took the third place among the gold producers a year ago, will not vary very greatly from its production of \$28,000,000 in 1900. By far the greater part of this comes, of course, from the Canadian Yukon. Operations in the Klondike and in all of the country which has Dawson for its center, are assuming a more settled character as claims become consolidated under the ownership of companies whose capital and machinery can be brought in to assist in the working. At the same time, the area of gold producing territory is being gradually extended by new discoveries, while improvements in transportation are making it possible to work propositions of comparatively low grade. It is in the last named direction chiefly that we must look for the further growth in the Yukon.

Outside of that territory, Canada's gold output comes from British Columbia on the Pacific Coast, from Western Ontario and from Nova Scotia in the extreme East. In British Columbia, conditions were not altogether favorable, as is shown by the extended report which follows. The Atlin country has produced less than was expected, while financial complications have seriously interfered with the operation of several of the great mines of the Rossland District, such as the Le Roy. In Western Ontario, the production last year was about the same as in 1900, and the same can be said of Nova Scotia.

*Russia.*—The production of gold in Russia will show little change from that of 1900 and will be not far from \$23,500,000. The reports so far received indicate some improvement in the Ural, a considerable one in the region about Irkutsk and in the placers around the head waters of the Lena. On the other hand, mining in the Amoor country has been seriously interfered with by the war in China. The catastrophe at Glagoviestchenk put a stop for some months to the operation in the rich placer country surrounding that city and they were not fully resumed before the close of the year. The expected opening of the gold-bearing region of Northern Manchuria has also been postponed. The increase in the Ural and in Western Siberia will barely make up for the deficit thus shown. In the Trans-Baikal there was little change in operations, although a new and important district is said to have been opened around the head waters of Shilka.

*The Transvaal.*—South Africa continued last year to be almost a negative quantity, so far as the gold supply was concerned. In 1898 the production of gold from the Transvaal mines amounted to \$78,070,761; 1899, when the mines were closed down in October by the breaking out of the war the production was \$72,961,500. In 1900 the operation of a few of the mines by the Government of the South African Republic in the months before the British Army took possession of the Witwatersrand, produced a total which our correspondents placed at \$7,208,867. In 1901, operations in a limited way were resumed in May by permission of the military authorities. The forces employed were very slowly increased, month by month, until the output reached in December a total of 40,000 ounces. The production actually reported this year to the end of November amounted to \$3,846,564, and the December work will bring the total up to \$4,700,000. Had it not been for the war, the Transvaal would undoubtedly have recorded an output of over \$100,000,000 for the year.

*Other Countries.*—In Mexico there was a moderate increase in gold production; and the same may be said of Central America where, in Salvador especially, some important new mines have been opened by American capital. None of the South American countries make complete returns and all that can be said is that mining in Colombia was almost stopped by the revolutionary troubles, while on the west coast, both Peru and Chile, are increasing their output.

In other parts of the world the only feature of importance are new developments in the Dutch East Indies, which promise well for the future. The West African mines have proved a disappointment so far,



and no other new gold producing region has been opened.

SILVER PRODUCTION

*The United States.*—The production of silver in the United States from ores mined in the country was approximately 59,500,000 ounces, or practically the same as in 1900. There was a decrease in the production in connection with lead ores, which is referred to under the head of "Lead." On the other hand, there was some increase in the silver-iron in connection with copper. The gain in the silver ores of Leadville and some other Colorado camps and in Utah is fully treated in the local reviews which follow. The Leadville increase was the most marked case, and the great and growing prosperity of that famous district is perhaps the most notable feature in the mining history of the year.

While there was little change in the silver produced from our own mines in 1901, as compared with the previous year, there was a large decrease in the quantity smelted and refined in this country from imported ores, base bullion and copper mattes. In 1900 the silver thus refined here from foreign material was 46,619,726 Troy ounces; in 1901 the quantity may fairly be estimated at 12,000,000 ounces less, or a total of approximately 34,620,000 ounces. This decrease was due to various causes. Little or no silver-lead ore came in from British Columbia during the second half of the year, our smelters having ceased for the time to take the ores from across the border. The quantity of ores from Mexico was less, owing to various causes, and the grade was in some cases lower. The conditions causing this decrease were mainly of a temporary character, and are likely to pass away before long, very probably during the year just opened.

*Silver Production of the World.*—The world's output of the white metal in 1901 undoubtedly showed some decrease. Mexico, the great producer next to the United States, showed a decrease from temporary causes referred to above—incidents in some large mines, suspensions of output pending new developments in others, and lower grade ores in still others. In Bolivia the great Huanchaca Mine has not kept up to the work of former years, though this deficiency was partly made up by increased output in Peru and Chile. The famous Cerro de Pasco mines, for so many years worked for silver alone, are gradually developing into copper mines with increasing depth, though the proportion of silver continues large. In Colombia mining was seriously interrupted by the unsettled state of the country.

The production of silver in Europe is not large, and varies little from year to year. In Australia the great mines of the Broken Hill District have diminished rather than increased their output. The varied questions affecting the working of the complex sulphide ores are not yet fully settled; while some of the smaller mines of the Barrier Range have been shut down on account of the low price of lead and the decrease in the demand for lead and silver in China.

THE COMMERCIAL MOVEMENT OF GOLD AND SILVER

The sudden cessation of gold output from the Transvaal was the great feature of 1900, and was undoubtedly one of the underlying causes of the present commercial depression in Europe. In 1901 there was no marked incident of this kind. The Transvaal is again a gold producer, but in a small way only, and it may be two or three years before it resumes its former rank.

The question of the disposition of the gold mined has been so often discussed in our columns that there is no occasion to go into it again at this time. We see no reason to change our former conclusion that, taking a series of years, not more than 25 per cent of the gold won goes to increase the monetary stock of the world, either as actual coin or as bank reserve basis for paper issues. In 1900 the amount so used undoubtedly exceeded the average, gold being sought for everywhere to make up the deficit from the Transvaal. In 1901 the average was probably again exceeded, though in a less degree. Exact data, from the nature of the case, cannot be had, but it is not

unreasonable to put the proportions for 1900 and 1901 at 35 and 30 per cent respectively. There was, outside of the general demand, no special call for gold in 1901. The accumulations for changes of currency in Russia and Japan were completed early in 1900; though Austria added slightly to her coinage stock last year. The attempt to convert the Indian currency has not been a success so far, and some of the gold accumulated for coinage purposes by the Indian Government has been released.

The demand for silver in the arts and industries in the United States remained large throughout the year, though it is probable that there was a decrease in Europe.

*Gold.*—The imports and exports of gold in the United States for the 11 months ending November 30 are reported by the Bureau of Statistics of the Treasury Department as below:

	1900.	1901.	Changes.
Exports.....	\$53,724,090	\$52,598,928	D. \$1,125,162
Imports.....	63,362,473	49,808,291	D. 13,554,182
Excess.....	*\$9,638,383	†\$2,790,637	D. \$12,429,020
*Imports.	†Exports.		

During 1901 but little gold was received here directly from Europe. We have, however, continued to receive by far the larger part of the gold mined in the Canadian Yukon. It comes to the Puget Sound ports and to San Francisco, because most of the supplies for the region are bought there, and because much of the gold is obtained and owned by miners from the United States. Other imports of gold were contributed by Australia and Mexico.

The exports of gold were mainly to France and Germany, very little going this year to Great Britain. The much discussed question of why we should be called upon to export gold when there is nominally an enormous trade balance in our favor, is too complex to be treated within our limits. Briefly put, it is most probable that the apparent trade balance has been largely covered by purchases of securities, by expenditures of travelers abroad, and in many other ways; and the exports of gold in the later half of the year were largely in payment of bankers' loans contracted at the time of the enormous industrial flotations which marked the earlier half of 1901.

Beyond all question the United States and France are at the present time the commercial countries containing the greatest accumulations of gold, but the trade conditions in the two are widely different. In the United States capital is everywhere in active use and it may be said that every dollar is employed; France is passing through a period of doubt and distrust and gold is hoarded in the Bank of France and among the people to a degree unknown for many years.

While the United States just now holds probably a larger accumulation of gold than any other nation in the world, the London movement of gold is still most important. The Board of Trade returns give the imports of gold into Great Britain for the 11 months ending November 30 as follows, in sterling:

Gold:	1900.	1901.	Changes.
United States.....	£5,867,880	£261,212	D. £5,606,668
Canada.....	452	.....	D. 452
Mexico and S. Am.....	1,217,590	1,425,860	I. 208,270
Australasia.....	6,004,709	5,225,508	D. 779,201
Transvaal.....	354,889	1,675,980	I. 1,321,091
Other Africa.....	341,368	1,185,835	I. 844,467
East Indies.....	3,587,952	6,758,315	I. 3,170,363
China.....	66,930	266,962	I. 199,132
Japan.....	324,138	17,080	D. 307,058
European countries.....	6,863,601	2,419,520	D. 4,444,081
Other countries.....	357,041	510,159	I. 153,118
Totals.....	£24,986,550	£19,745,531	D. £5,241,019

There was in 1901 a large falling off in the receipts from the United States. The gold we have exported this year has gone to Paris rather than London. The amount received from India in 1901 was unusually large, and shows, we think, that the India Council has been to some extent meeting its liabilities in London by drawing on the gold reserve which it had accumulated in the attempt to establish a gold currency in India. The Council borrowed little in London during the year, the surplus of the money market having been absorbed by the continued demands of the Imperial Government on war account. The falling off in receipts of Australian gold was chiefly the result of shipments made direct from Australia to

India and the United States. Australia took comparatively little capital from London in 1901, the flotation of new mining companies having been difficult, while the heavy borrowing by the colonial governments, which marked several previous years, was suspended on account of the unfavorable conditions of the money market.

The exports of gold from Great Britain for the 11 months are given below:

Gold:	1900.	1901.	Changes.
Russia.....	£120	.....	D. £120
Germany and Hol'd.....	3,495,265	£2,667,636	D. 827,629
Belgium.....	38,050	33,070	D. 4,980
France.....	1,942,611	1,650,441	D. 292,170
Gibraltar and Malta.....	67,600	70,100	I. 2,500
South Africa.....	1,780,162	300,171	D. 1,479,991
West Africa.....	59,531	23,993	D. 35,538
Egypt.....	1,136,445	167,620	D. 968,825
India.....	2,527,039	2,340,801	D. 187,238
China.....	8,500	.....	D. 8,500
Japan.....	535,000	100,000	D. 435,000
Mexico and S. Am.....	2,126,384	1,995,092	D. 131,292
United States.....	1,082,500	52,050	D. 1,030,450
Other countries.....	1,049,123	2,924,766	I. 1,875,643
Totals.....	£15,848,330	£12,325,740	D. £3,522,590

This table is of interest chiefly as showing that Great Britain has been holding the gold received more fully than in 1900. While there was a considerable movement to France and Germany the total sent to European countries was much below the previous year, though it was still greater than the receipts. The amount sent to the United States in 1901 was insignificant; but it must be remembered that a considerable amount—about £2,000,000—was sent from Australia to the United States on London account. South Africa took less gold from London in 1901, notwithstanding the continued war expenditures; but here again there were large shipments from Australia on British account, which amounted to nearly £3,000,000.

The statements of the four great banks of Europe show the gold balances held at the close of December in 1900 and 1901 as below, in dollars:

	1900.	1901.	Changes.
Bank of England.....	\$150,661,315	\$171,960,645	I. \$21,299,330
Bank of France.....	465,334,225	492,896,115	I. 26,561,890
Bank of Germany.....	132,910,000	158,965,000	I. 26,055,000
Bank of Russia.....	360,120,000	339,475,000	D. 20,645,000

The features of this statement are the increase shown by the Bank of Germany in the face of the industrial crisis in that country; and the fact that the Bank of Russia has lost so little under unfavorable conditions. The accumulation of the Bank of France illustrates the continued congestion of capital in that country, where a prevailing lack of confidence prevents its free use.

*Silver.*—The imports and exports of silver to and from the United States for the 11 months ending November 30 are reported by the Bureau of Statistics of the Treasury Department as follows:

	1900.	1901.	Changes.
Exports.....	\$58,863,325	\$50,914,826	D. \$7,948,499
Imports.....	36,982,486	28,358,192	D. 8,624,294
Excess, exports.....	\$21,880,839	\$22,556,634	I. \$675,795

The report does not separate the silver imported as metal from that which is contained in ores, lead bullion, copper mattes and blister copper. The decrease in imports in 1901 was in part in lead-silver ores from British Columbia, and in part in receipts from Mexican mines. The decrease in exports was largely in shipments to the East, those from San Francisco direct to China alone accounting for over \$5,000,000 of the loss. The lower value of silver this year must also be taken into account.

London continues to be still the great silver market of the world, and its trade forms a most important feature in the movement of the white metal. The total imports of silver into Great Britain for the 11 months ending November 30 are given in the Board of Trade returns as below:

Silver:	1900.	1901.	Changes.
United States.....	£10,235,640	£8,981,366	D. £1,254,274
Mexico and S. Am.....	468,030	484,605	I. 16,575
Australasia.....	139,515	183,345	I. 43,830
The East.....	931	1,727	I. 796
Africa.....	96,924	160,792	I. 63,868
European countries.....	923,507	742,450	D. 181,057
Other countries.....	6,646	32,029	I. 25,383
Totals.....	£11,871,193	£10,586,314	D. £1,284,879

According to these returns the United States furnishes London with the greater part of its silver, the proportion credited being 84.9 per cent of the total in 1901, against 86.2 per cent in 1900. It must be remembered, however, that a considerable proportion of this



is Mexican and Canadian silver put into marketable form and sold abroad by our smelters and refiners.

The exports of silver from Great Britain for the 11 months are given as follows:

Silver.	1900.	1901.	Changes.
United States.....	£29,500	£72,000	I. £43,500
Canada .....	45,914	31,938	D. 13,976
Mexico and S. Am. ....	93,263	126,466	I. 33,203
Australasia .....	297,350	193,150	D. 104,200
Africa .....	690,300	349,628	D. 340,672
The East .....	9,080,010	8,093,259	D. 986,757
European countries ..	1,710,309	1,359,361	D. 350,948
Other countries....	273,823	621,321	I. 347,498
Totals .....	£12,219,469	£10,847,123	D. £1,372,346

A singular fact shown in this table is that London actually shipped more silver to Australia than was received from that country, although New South Wales has the greatest silver mine in the world. The great customer for silver, however, in Eastern Asia, and the shipments there from London are shown separately in the following table:

	1900.	1901.	Changes.
British East Indies..	£6,629,176	£6,995,673	I. £366,437
China .....	2,361,034	1,077,646	D. 1,283,388
Japan .....	89,800	20,000	D. 69,800
Totals .....	£9,080,010	£8,093,259	D. £986,751

This illustrates the statement, which has been heretofore made in our columns, that the decrease in silver shipments to the East has been wholly due to the disorganized state of business in China. That country took in 1901 less than half the silver it required in 1900. The increase in shipments to the British East Indies was largely due to the increased exports of tin from the Straits. India proper took rather less from London than in the previous year; though a considerable quantity of the Australian silver—which has heretofore gone to China—was this year shipped direct to India, thus diminishing the amount taken directly from London. It is to be regretted that we have no complete returns from Australia, as they are needed to make clearer the somewhat obscure question of the silver movement in the East. Japan has ceased to be a factor of importance in the silver market.

The fact remains that the Far East continues to take nearly one-half of the world's silver output, and to retain it, since very little is returned in any shape. This has been the case ever since trade between Europe and Eastern Asia was established, and it is a condition of which no one can foresee the end.

The monthly average prices of silver in New York and London in 1900 and 1901 were as follows, the New York price being in cents and the London in pence per troy ounce:

Month.	1900.		1901.	
	London. Pence.	N. Y. Cents.	London. Pence.	N. Y. Cents.
January .....	27.30	59.30	28.97	62.82
February .....	27.49	59.76	28.13	61.06
March .....	27.59	59.81	27.04	60.63
April .....	27.41	59.59	27.30	59.29
May .....	27.56	59.96	27.43	59.64
June .....	27.81	60.42	27.42	59.57
July .....	28.23	61.25	26.96	58.46
August .....	28.13	61.14	26.94	58.37
September .....	28.85	62.63	26.95	58.26
October .....	29.58	63.83	26.62	57.59
November .....	29.66	64.04	26.12	56.64
December .....	29.68	64.14	25.46	55.10
Year.....	28.27	61.33	27.11	58.95

In making comparisons of these prices it must be remembered that the New York price is per ounce of fine or pure silver; while the London quotation is per ounce of so-called sterling silver, 925 fine.

The increase in prices in 1900, which reached its culmination about the close of the year, was reversed in 1901 and the quotations fell throughout the year, more rapidly in the second half. The lowest point was reached in December.

**CALIFORNIA MINES IN 1901**

BY OUR SPECIAL CORRESPONDENT.

The mining industry in the State of California is in a more prosperous condition than has been the case for many years, which is largely due to the fact that a field of a more diversified nature is being exploited. In the earlier days of mining in the State gold alone was sought for and little attention was paid to anything else. The quicksilver mines were productive, it is true, but they cut a small figure as compared with gold producing properties.

During the last decade, however, other kinds of mining have been prosecuted, until at present the annual record of mineral output includes the value of some 45 substances. Moreover, the combined value of the copper, petroleum, quicksilver, borax, structural materials, etc., has become about as large as that of the gold product alone.

Another fact in the increasing production is the opening up of new mineral fields as railroad facilities are extended throughout the State, giving means of transportation to the smelters, etc., as well as an opportunity for hauling in machinery to be used at the mines themselves.

Still more important to enlarged development are the improvements in the direction of power supply, especially for the hoists, pumps and mills of the gold mines. In this electricity plays a prominent part. The magnificent streams of the Sierra Nevada and of the foothill region are now called upon to do their share in the work of general advancement by furnishing power for the generation of electricity. This is being transmitted in all directions throughout the more populous mining sections of the State and in many instances at isolated points.

And what is considered by many as even a cheaper power is steam generated with petroleum oil as fuel. It is only within a year that much has been done in this direction, or since the development of the heavily-producing oil fields of the great central valley of the State. The oil of Kern and Fresno counties, very cheaply produced, are now being utilized as fuel at the mines in the northern tier of counties of the State; and that from the Los Angeles, Orange, and Ventura counties gives abundant fuel supply for the mining regions of the southern counties. A number of the larger mines in the Mother Lode Region are now using oil as fuel, the general understanding being that about 30 per cent is saved over the cost of wood.

Probably the most marked features of mining development in California during the past year are connected with copper, petroleum and quicksilver, in which much has been done in a progressive way.

It is found that the most productive county in the State, leading all others by several millions yearly, is that in which the greatest developments in copper mining have occurred. This has stimulated prospecting and development along the entire copper belt in the State. Shasta County is the center of this activity, and there large investments have been made during the past year. Additional smelters have been erected and set at work and others are planned. Numerous mines are being opened throughout the copper-yielding counties—Shasta, Trinity, Amador, Calaveras, Madera, Fresno, Mariposa and San Bernardino. In other counties as well work is being done in this direction. In 1900 California produced 29,515,512 pounds of copper, valued at \$4,748,242, and the records of 1901, when completed will show a marked increase, several new smelters having been erected during the year.

A very important feature of the development of copper mines, is the bearing it has on the gold quartz mines. Wherever the copper smelters are put up there is an active demand for quartz ores for flux, and this enables hundreds of miners to work for themselves on their own claims, without needing capital to put up mills. They can sell their ores, of almost any grade, at a good profit, they being paid on percentage of contents. In Shasta County this feature has stimulated prospecting to a remarkable extent, the quartz ores not only coming from that but neighboring counties to the smelting works. A great many mines having ores of too low a grade to warrant special reduction works have by this means been made active and profitable.

There are several known copper deposits in different counties which are as yet undeveloped, though they are now held at much higher values than was the case a few years ago.

In quicksilver there has been a veritable boom. California has for 50 years been yielding practically all the quicksilver produced in the United States. For the past 10 years or so, however, only the larger well-

known mines have been worked, numerous smaller ones having been left idle. During the past year many of them have been reopened and reduction works erected. A number of locations hitherto unopened, have also been prospected and all the quicksilver claims of the State have a value as prospective mines. The principal quicksilver yielding counties of the State are Lake, Napa, San Benito, Santa Clara, and Sonoma. The counties of Colusa, San Luis Obispo and Trinity also produce some.

Possibly the petroleum developments in California for the past two years may be considered the most important in the mining field, although the profits have not been as great or as general as was to have been expected. This result has not been due to lack of producing wells, but to excessive cost of transportation from the oil fields to market centers. The oil from Los Angeles, Ventura and Santa Barbara counties may be carried by rail or sea, and there has been no trouble concerning those counties; but the wells of Fresno and Kern counties have been dependent, as they must be, upon carriage by rail. The railroad rates have been considered so excessive that there has been much complaint from producers, and the matter was brought to the attention of the State Railroad Commissioners. This body after much testimony had been taken, finally reduced the rates on transportation and switching about 11 per cent. But this does not satisfy the oil men, who still consider they are being charged too much.

A pipe line is now being surveyed from the Kern and Fresno fields to the shores of San Francisco Bay, and very extensive refining works are being put up by the Standard Oil Company at Point Richmond on the bay shore near San Francisco. Other refineries have also been erected at different points by other parties. The principal oil fields are in Los Angeles, Orange, Ventura, Fresno, Kern and Santa Barbara counties, but much prospecting is going on in many other counties of the State with more or less success. A great deal more capital has been put into the petroleum business than into any other part of the mineral industry of the State within the past few years. Naturally there have been many "wild-cat" companies, but these are gradually being eliminated and the industry brought to a more legitimate basis. The lands in the great central basin of the State have vastly increased in value with the possibility of finding petroleum and the discovery of it. There are hundreds and hundreds of producing wells, and the yield is rapidly increasing from year to year. The consumption is also on the increase, most of the larger manufacturing and industrial enterprises in the principal cities now using oil as fuel instead of the more costly coal. Thus a market is made for the oil, and this is growing wider every month. The railroad companies have been unable to furnish sufficient cars to haul the oil from the fields, and this has restricted production and lowered prices. All this is being remedied, however, and the oil business has a great future before it. There is scarcely a county in the State where some well boring is not going on and the older oil yielding counties are increasing their production.

Gold continues to be, as always, of the first importance in point of total yield among the mineral products of the State, the aggregate being about one-half that of all substances combined. Moreover the gold yield is gradually but slowly increasing from year to year.

The amount of gold obtained from the mines of California each year depends to some extent upon the amount of rainfall of the season. For the past three seasons, "dry years" have been experienced, when the rainfall has been less than normal and there has been little snow in the mountains. With slight snow-fall in the higher ranges there is little water-supply for the rivers in the dry summer months. As a result, the gravel miners particularly, have suffered. In some localities where they usually have four or five months' water for gravel washing, etc., they have only had enough for six weeks or two months. And in the quartz mining regions, where the ditches supply water for power and for milling, the exhaustion of the reservoir supplies and drying



up of streams have occurred so early in the fall, that number of mines with no auxiliary steam power, have been compelled to hang up their stamps and discharge their miners for one or two months or longer.

The usual conditions, occurring for three consecutive seasons, have had a serious effect of the gold output of the State. The total amount has kept about the same during each of these three years, which proves that there are a number of more productive mines, both gravel and quartz. Otherwise a marked falling off in total yield would have been noted.

A number of the older mines of the State, abandoned years ago when quartz had to be rich to pay profits under the then prevailing conditions, have of late been reopened, suitably equipped and made profitable.

With improvements in methods of mining, and more especially in methods of milling, concentrating, cyaniding, etc., cheapened supplies and power, and business-like, commercial management, mines which 20 or 25 years ago were unprofitable to work, can now be made to pay well. Under the changed conditions very low grade ores may now be made profitable. In fact, especially on the Mother Lode Region, where deep mining prevails, some of the most profitable mines of the present day are those which lay idle and full of water for 20 to 30 years. The advent of capital to re-open these mines was an important factor. In the old days the mine was expected to pay its way, its development and the profits. Now deep shafts are sunk to tap the known ledge, and suitable machinery set in place for deep mining, before any profit is expected. These investments, with few exceptions, have paid well.

In addition to these older mines there are many others worked for a long time on a small scale by their owners, which have been purchased by men of means or companies, and suitably equipped for more extensive mining and milling operations. Then again there are naturally many new claims discovered and opened each year which have become productive.

Within the past few years California has been fortunate in enlisting the aid of capital from the Eastern States and abroad in the development of its mining resources. A great many mines have been purchased, and good plants of machinery put upon them. Active development has been carried on, and the mines brought to a productive stage, which could not have been done by their original owners with no more money than that obtained from the mine itself.

An example of this nature may be cited in the case of a certain quartz mine known for years to be a valuable one, but which lay idle for want of capital to put it in proper shape. Boston men purchased it, put in a dam for water-power purposes, built ditches and flumes, ran a long tunnel, and fully opened the mine, proving its ore resources, and built a large mill. In doing this they expended some \$700,000, with no expectation of returns until the whole plant was completed and the mine opened. They will start up the mill in January with every promise of large profit. Another example is that of a hydraulic mine in the northern part of the State, which had never been worked, owing to the immense expense of bringing in water for the giants. Eastern men have taken hold of this and will spend about \$1,000,000 for water rights, ditches, flumes, pipe-lines, etc. Four or five hundred men have been at work all summer, and the total investment for mine and plant will be between \$5,000,000 and \$6,000,000. In another case, that of a copper property known for 30 or 40 years, yet lying idle for that time. An English company took hold of it, opened and equipped it at large expense, and the mine is now yielding over \$5,000,000 a year gross and paying handsome dividends regularly.

For large operations of this kind the need of capital has long been felt, but it is now coming into the State in a satisfactory manner. There are abundant opportunities for investments of this character, not only in gold, copper, quicksilver and petroleum, but in many other substances.

It is interesting to note that of the \$17,373,699

gold and silver produced in the State in 1900—the last year of which complete statistics are available—the sum of \$14,058,137 was derived from quartz mining operations which shows the ascendancy of that class of mining. When mining first commenced in the State the gold was practically all derived from surface placers, but in time, as these deposits were exhausted, attention was turned to quartz, which now yields the bulk of the gold. In the same year \$1,367,016 came from hydraulic mines; \$1,018,246 from drift mines; and \$930,250 from placers, including diggings worked by rocker, sluice, tom, ground-sluice, dredgers and from beds and bars of rivers.

Hydraulic mining, while still continued in the counties in the drainage basin of the Sacramento and San Joaquin rivers, is no longer of so much importance in making up annual total output as it formerly was. Under the present laws the output is restricted, owing to the necessity of impounding the debris or tailings. When the material passes into the settling basins behind the impounding dams, it must be sufficiently settled so that there will not be too much silt, etc., passing out with the water. If the water carries too large a percentage of solids the California Debris Commission will withdraw the license to mine by that method. This settling takes time, and but a small quantity of gravel can be washed as compared with the days when the mines worked at full head of water and the tailings went down the streams as they pleased. Some of the large mines drift their deposits as well as wash them with giants. In the northern counties of Trinity, Siskiyou, Del Norte and Humboldt, where the mines drain into streams emptying into the Klamath, a non-navigable stream, the restriction does not apply, so no impounding works are necessary. For this reason hydraulic mining flourishes in that region, and many large investments have lately been made. There are still large areas of such ground upon which water has not yet been brought.

The business of using machine dredges for gold mining has taken great strides during the past two years, and particularly in 1901. These dredges, though expensive to construct, have been found to be profitable even on auriferous gravel of comparatively low grade. The center of activity of this class of mining is near Oroville in Butte County, along the Feather River and the low lands adjacent; but there are also dredges on the American, Klamath and other streams in other counties. At Oroville the work is not confined to the river-bed proper. Indeed most of the dredgers are at work on land a mile or more from the streams. They dig a pit in the midst of a bearing orchard out in the valley, build the hull of the boat in it, and then put the machinery in the hull. The dredge, as work progresses, prepares its own excavation in which it floats, seepage or surface water giving all that is necessary to float the boat. The tailings, rocks, etc., pass out behind the dredge, partly filling in the space it formerly occupied. The trees of the orchard go down before the buckets of the dredge. Large tracts of land have been purchased by the dredging companies not only at Oroville but at other points in the State where the conditions are favorable for this class of work.

Gold and silver are now produced in 32 counties of the State, the leading ones in the order of their productiveness being Nevada, Calaveras, Tuolumne, Amador and Shasta. Each of these produced over \$1,000,000 with the combined metals, Nevada exceeding \$2,000,000. In gold alone, the order of rank of those counties yielding over \$500,000 each is: Nevada, Calaveras, Tuolumne, Amador, Placer, Siskiyou, Kern, Shasta, Mono, Sierra and Trinity. Over one-third of the silver comes from Shasta County, being derived from ores treated at the copper smelters.

In drift mining no very special developments are to be noted. The center of activity in this line is on the Forest Hill Divide in Placer County, although it is carried on elsewhere. Some of the work in drift mining is of a very extensive nature, exceedingly long tunnels being run to develop the channels of the buried rivers where the gold is obtained. Considerable capital is necessary in prosecuting work of this

nature, which is the main reason why more enterprises in drift mining are not carried on. In many cases it takes several years for the channel to be reached, during which time there is no chance for any income from the mine. However, in most cases where extensive drift operations have been carried on the outcome has been profitable.

California was the pioneer in gold mining of all the States and territories West of the Missouri River and for about 50 consecutive years held first rank in gold production until a few years since, Colorado took first place, and California dropped to second, which it now holds. For total gold output, however, California holds a record which it will take any other State many a year to equal. Since mining first commenced in California the State has yielded the gross sum of \$1,345,576,044 in gold alone without counting quicksilver, borax, copper, silver or any other substance. And the output still goes on at the rate of \$16,000,000 or \$17,000,000 a year, with good prospects of a marked increase for some time to come. Another record held by the State is not likely to be beaten. That is the largest single year's output of gold—\$81,294,700 in the year 1852. In fact it was not until 1857 that the annual yield of gold fell below \$50,000,000. Nearly all forms of gold mining are still carried on in California, as gold is obtained from quartz, pocket, seam, hydraulic, drift, ocean beach sand, dredging, wing damming, dry-washing, surface placers, etc.

While gold mining still holds first place as to value of annual yield there are now many other substances which go to make up the grand total. The relative rank of the principal products as to annual value are as follows: 1st, gold; 2nd, copper, 3rd, petroleum; 4th, silver; 5th, quicksilver; 6th, borax. In the year 1900 when the total value of all mineral products was fixed at \$32,622,946, that of the metallic substances was \$23,358,730; of non-metallic substances \$2,177,197; of hydrocarbons and gases \$4,512,951; and structural materials \$2,574,067.

While mineral deposits of varied characters are scattered throughout the State there are many which, while known, have not as yet been developed and utilized. A good idea, however, may be had of the localities where work is being prosecuted by enumerating briefly the substances and source by county according to latest available statistics.

Asphalt is produced in Fresno, Kern, Los Angeles, Ventura and Santa Barbara counties, the latter yielding the bulk of it. While asbestos is known in several places, Riverside County is the only producer. Bituminous rock comes from San Luis Obispo and Santa Cruz counties, mainly from the latter. The borax comes largely from San Bernardino County, though some is derived from Inyo. Brick clays are utilized in nearly all the principal counties of the State. San Bernardino has thus far been the only producer of hydraulic cement, though new works are being put up in Solano County. Alameda is now the largest producer of coal, though it is mined also in Contra Costa, Amador, Orange and Riverside counties. The copper yield comes from Amador, Calaveras, El Dorado, Kern, Madera, Mariposa, Nevada, San Bernardino and Shasta counties, the latter, however, yielding far more than all the others combined.

Calaveras, Alameda and Nevada counties produce all the pyrites. Granite quarries are operated in Madera, Placer, Riverside, Sacramento, San Bernardino, San Diego, Trinity, Santa Barbara, Tulare and Ventura. The fuller's earth comes from Kern County; gypsum from Los Angeles and Tulare; and lead from Inyo, Mono and San Bernardino counties. Limestone is quarried in many counties both north and south, and this is the case with macadam. All the lithia-mica comes from San Diego, and the marble from the Amador County quarries. Magnesite is mined and calcined in Alameda, Tulare, Napa and Santa Clara counties, Napa being the leading one. Mineral paint is mined in Calaveras and Stanislaus counties, that from the latter being ocher. Mineral springs, the waters of which are utilized commercially, are found in 17 counties of the State. Natural gas is utilized in Sacramento, San Joaquin and Santa Barbara counties.



The so called basalt paving blocks are quarried in Sonoma, Solano and San Bernardino counties.

The petroleum production is from the counties of Fresno, Kern, Los Angeles, Orange, Santa Barbara and Ventura, though wells have been sunk in many others, some of which are now yielding. Quicksilver is derived from the counties of Colusa, Lake, Napa, San Benito, San Luis Obispo, Santa Clara, Sonoma and Trinity. Quarries for rubble railroad ballast are operated in Los Angeles, Marin, Monterey, San Diego, San Francisco, Santa Barbara, San Luis Obispo, San Mateo, Solano and Ventura. The California salt is from Alameda, Colusa, Riverside and San Diego, the largest amount being from the first named, where it is made by evaporating water from San Francisco bay. Sandstone is quarried in Colusa, Los Angeles, Orange, Santa Barbara, Santa Clara, Ventura and Yolo counties. The quartz sand is from Riverside; glass sand from Monterey; serpentine from Los Angeles; slate from Eldorado; soda from Inyo; tourmaline from San Diego and turquoise from San Bernardino County. Gold is mined in 32 counties of the State, Nevada leading the list, and silver in 26 counties, Shasta taking the lead.

As showing the gradual increase in value of the mineral products of California during the past few years the following official figures are given:

1893.....\$18,811,261	1897.....\$25,142,441
1894.....20,203,294	1898.....27,289,079
1895.....22,844,663	1899.....29,313,460
1896.....24,291,398	1900.....32,622,945

This shows an increase of about \$2,000,000 a year for the past 8 years. For 1901 the increase is expected to be still greater, owing to the enlarged yield of copper and petroleum in addition to that of other substances.

This is a pretty good record for a State which has been engaged in mining for over half a century, and which at one time not many years since was looked upon as "played out" from a mining point of view. The minimum of production was reached some years since during a period of depression, but a marked increase is now apparent each year.

To show what is being done of late it may be well to quote from a table prepared by the State Mining Bureau of California showing the value of production of a mineral nature for the past 14 years, from 1887 to 1900 inclusive, as it shows the varied products as well as total values for the period named.

Substance.	Value.
Antimony.....	\$71,455
Asbestos.....	23,400
Asphalt.....	2,607,743
Bituminous rock.....	1,977,819
Borax.....	9,476,269
Cement.....	629,406
Chrome.....	302,800
Clay (brick).....	5,250,517
Clay (pottery).....	635,135
Coal.....	3,667,776
Copper.....	14,286,555
Fuller's earth.....	16,150
Gold.....	197,001,325
Granite.....	7,365,300
Gypsum.....	322,346
Infusorial earth.....	5,875
Iron ore.....	3,500
Lead.....	523,647
Lime and limestone.....	4,775,937
Lithia mica.....	15,600
Macadam.....	3,022,151
Magnetite.....	185,729
Manganese.....	65,241
Marble.....	666,652
Mineral paint.....	99,160
Mineral water.....	3,276,423
Natural gas.....	778,368
Onyx and travertine.....	91,400
Paving blocks.....	31,636
Petroleum.....	19,414,706
Platinum.....	15,301
Pyrites.....	79,753
Quartz crystals.....	18,000
Quicksilver.....	16,633,235
Rubble.....	2,797,708
Salt.....	1,859,200
Sand (glass).....	4,000
Sand (quartz).....	1,700
Sandstone.....	1,382,249
Serpentine.....	19,500
Silver.....	11,302,110
Slate.....	169,489
Soapstone.....	18,125
Soda.....	696,500
Sulphur.....	50
Tin.....	59,964
Tourmaline.....	500
Turquoise.....	20,000
Totals.....	\$311,667,707

LEADVILLE MINES IN 1901.

(By Our Special Correspondent)

The past year has been very successful. The ore bodies opened during 1901 have been largely sulphide deposits and in both the gold belt and the silver-lead belt the sulphide zone has proved of wonderful extent. The total tonnage is about 850,000 tons of all classes of ore, of which some 35,000 tons were zinc, 80,000 manganese-iron and the remainder smelting ores. This immense tonnage gives a valuation of a little over \$12,000,000 and makes the total value of Leadville's production for the past 35 years \$287,600,000. The tonnage would have been considerably larger this year had the smelters been able to handle the sulphides. The sulphide tonnage could easily be increased 1,000 tons a day, but the smelters say they have not the roasting capacity and that there is not a sufficient supply of siliceous ores.

The sulphide bodies on the silver-lead belt have been opened principally through the A. M. W., Small Hopes and Greenback combinations. On the gold belt the principal sulphide producers are the Resurrection, New Monarch and others, while the Diamond, Sedalia, Forest City and Fortune are sinking to open the same shoot. The probable sulphide tonnage is really enormous and the smelters must solve the problem. The extension of the iron shoots in the Leadville basin has been clearly proved this year as the wonderful ore bodies opened in the Home and Midas bear witness. The zinc situation is very bright, as it has been clearly proved that zinciferous ores can be profitably handled and the new smelter at Pueblo will give a market of 600 tons a day. The extension of the railroads to all important mines, the diminishing of the water in the downtown mines, the extension of the mineralized area, the forming of combinations to develop territory now lying idle, the increased investment of eastern capital make a happy opening for the new year.

**Carbonate Hill and Graham Park.**—In this section the A. M. W. group, the Marian, the Midas and the Greenback have opened up great bodies of sulphides while much new work has been done by others. The A. M. W. has acquired more ground during the year and it is doing a lot of work through its Wolfstone shaft. The company is shipping about 200 tons a day but could ship much more if there was a market for its sulphides. Drifts are being run to connect with the old Mahala ground recently purchased for \$95,000. Some fine zinciferous ores are being developed and handled by the A. M. W. concentrating mill, one of the most complete in the district. The Midas, controlled by the same combination, has produced almost 50,000 tons during the year. It has a very strong iron shoot which is showing better than ever and which averages \$5 net to the ton. Sufficient ore is blocked out to continue shipments several years at the present rate. The Gallagher dump on the Mikado territory is shipping 75 to 100 tons a day and netting a nice profit. The Toledo Avenue Company, after sinking its shaft, is now drifting for an ore shoot. The Catalpa is developing a good grade of iron and is not shipping manganese ore. The Arnold Mining and Leasing Company has prosecuted development all the year, but so far without ore results, while the Thespian group and a consolidation of the Valley-Forest Rose territory are to be actively developed during 1902.

The greatest results realized have been in Graham Park, south of Carbonate Hill, where the sulphide shoot shows an extension. The Small Hopes besides operating successfully its own and leased territory has had very good results on the sub-leasing system. The work through the Marian has resulted in opening enormous sulphide bodies at and below the 1,200-ft. level. The Greenback property has sunk to the lower contacts and opened up immense sulphide bodies from which shipments would be regular was the ore now marketable. The Evalyn, a new company, sank a deep shaft during the year and is now prepared to develop its sulphide ores. The Ri-

alto Company finished its deep shaft, but was tied up for some time owing to financial difficulties and stockholders' differences now settled. December saw the mine drained and heavier machinery installed to carry ahead work below the 1,100-ft. level. The Tarshish had a streak of hard luck early in the year, but now shows signs of making a steady producer. The Morning and Evening Stars on Carbonate Hill, the Modoc, the Yankee Doodle and a number of others are in the hands of lessees and have done the usual amount of development work and made some shipments.

**Leadville Basin.** No section of the camp has shown more substantial results than this and there are indications that much of the city is underlaid with ore. The New Leadville Home Mining Company, a reorganization of the Home Mining Company, which unwatered the Home territory through Penrose ground, has paid on its original investment of \$50,000 over \$240,000 in dividends and carried ahead developments which show in one property, the Penrose claim, over \$280,000 worth of ore. The company is now capitalized at \$2,000,000 and little stock is for sale at 23 cents. The Nubian Mining Company has had a very successful year and through its Midland and P. O. S. shafts has opened up a rich iron shoot. The Weldon is now prepared to operate the same ore shoot as was located above. The Morocco Mining Company has put down a new shaft, the A. V., at the foot of Harrison Avenue, where a drift is being run. The Valentine and California Gulch companies, which started out with bright prospects the first of last year, have not accomplished much and have been closed down for some time on account of financial difficulties. It is thought that both projects will give results with a little more work. The Home Extension Company is not working, though early in the year the shaft cut a fine body of manganese-iron that will be developed. The new Cloud City Company, in the heart of the east side residence portion of the city, is drifting on top of the ore at something over 500 ft. The Phoenix Mining Company, operating the old Sixth Street Mine, has become a heavy producer of manganese during the last 60 days. The ore goes to the steel works at Pueblo, which have an interest in the mine. The Caribou, formerly the Bison, during the year, has opened up an immense manganese-iron body producing 150 to 200 tons a day besides a body of better grade ore. Near the Boston Gold-Copper Smelter the Big Evans Mining Company has 150 acres and is preparing for extensive work through the Hoffer shaft in almost virgin ground. The Maple Street Company, far to the west and in undeveloped ground, is soon to be working again. The shaft is down over 500 feet and a diamond drill has shown ore below. North of the Maple is the Homer placer, also virgin ground where the Leadville Tunnel and Drainage Company has sunk nearly 200 feet and is to explore with a diamond drill its combination of about 150 acres. The same condition exists at the Capitol Hill shaft.

**Yankee and Fryer Hills.**—Lessee work has been the main development of the year and a small tonnage has come from ground above water level, including leases on the Pittsburg, Little Chief, Cady, Fairview, All-Right, Buckeye, Chrysolite, New Fryer Hill Company and a number of smaller propositions which in addition to low grade iron occasionally open a new pocket. The New Elkton, an English company, is prospecting, but the work of the past 6 months has not revealed shipping ore.

**Iron and Rock Hills and California Gulch.**—The Yak Company is pushing its big tunnel into Breece Hill. Immense bodies of sulphide and other ores are being opened and shipments have jumped from 25 to 200 tons a day and these will be increased. On Iron Hill the Iron Silver Mining Company has been doing development on its Stevens territory and has been producing 200 tons a day from its Moyer workings that yield a very good zinc concentrate at the Moyer Mill. Lessees on the A.

Y. & Minnie Mine have produced steadily good grade ore. The zinc sulphide ores have given a very satisfactory concentrate at the mill and enabled the leasing company to pay big royalties and make a snug fortune for itself. The Rubie and the Louisville have been producing under lessees. A new combination just formed is to work the Star of the West group under the direction of G. H. F. Meyer and work has started on the 500-ft. shaft to the lower contacts. On the White Cap on the Iron Hill slope the Nayr Mining Company sank from 500 to 700 feet and recently opened up a fine lead sulphide. This is the first time sulphides have been caught on that part of the hill. Over on Rock Hill the usual number of lessees are at work. There is talk of the old La Plata combination owned by English people being developed. The new Crown Point shaft is being supplied with machinery and work will start at once below the 800-ft. level. The Gordon consolidation and the work of the lessees on the Benton in Adelaide Park show encouraging conditions.

**Leadville Gold Belt.**—The work of the past year has greatly increased the area of the gold belt, and Brece Hill and its tributary territory is one of the most important sections of the district. The Ibez mines have added to their miles of drifts and levels and shipped from 200 to 250 tons a day. The Resurrection Company has opened through both shafts enormous sulphide deposits, and can ship 300 tons a day for a long time. The New Monarch through its Lida, New Monarch and Winnie shafts has opened the same sulphide deposits, and can ship 300 tons daily. This sulphide shoot has also been caught in the Forest City, while the Diamond, the Vega, the Sedalia and the Fortune companies are all sinking to open it. At the Penn combination shipments have ranged from 50 to 100 tons a day, but owing to a low-grade deposit now being developed are held down to 50 tons a day. The Ballard has opened up a fine gold-ore body high, and was a steady producer until December. The Big Six Company has settled its legal difficulties, and lessees are making a regular tonnage. The Lillian under lessees has done fairly well all year, making regular monthly shipments and receiving good royalties. The South Winnie, a local company that leased a fraction of the old Fanny Rawlings territory, has opened up in two levels a very good gold ore shoot and paid three dividends. The Gold Basin Mining Company has finished its shaft on the old Big Four Territory and drifted out gold ore assaying \$300 to \$500 gold, from which shipments are to start at once. The Elk-Donovan group has developed a good gold ore, and for several months made steady shipments. The Esteyes are showing good results from their work on the Chippewa. The Ohio, one of the new deals, has cut some very good ore shoots, and in one of the drifts the ore is opening out nicely. The Golden Eagle has received some nice royalties from its Little Vinnie lease, which has produced all year and shows a strong ore shoot. A combination has been formed to work the old Printer Boy property on a large scale, but trouble with the manager has temporarily stopped work. At the Banker a rich streak has just been cut in two different levels of No. 2 shaft, which it is thought will lead to an ore body. The Mammoth, Josie, Pilgrim, Black Prince, President and a few others of that locality have been doing some work, and will be heard from during 1902.

**Outlying Territory.**—Sugar Loaf has shown the greatest activity; the Dinero, the Gunnison, the Fanchon combination, the Black Iron, and the Bartlett being among the most promising projects. Iowa Gulch shows a renewal of work on the Long & Derry combination, the work of the Empire Mining Company, a resumption of operations on the Rex by the Keystone Mining Company, headed by Pennsylvania men, the drainage of the First National and its steady production, opening of ore in the Grover Cleveland and Jay Bird, and work of promise. The Homestake after years of idleness has resumed, and is making heavy shipments from a fine ore body. In Lake Park a combination with a capitalization of \$1,000,000 has just been formed to work the Hap-

Hazard on a large scale. The work of the Gold Bug and the preparations by its New York owners for next spring, the new discoveries on Prospect Mountain of magnetic iron ore and the proposed development by tunnel; the proposed tunnel into Ball Mountain and other prospecting work in that locality, and finally the continued activity in Dewey, Twin Lakes, Taylor Hill, Alicante and other smaller outlying territory shows conclusively that the mining industry of the Leadville District is still in its infancy.

#### SAN MIGUEL COUNTY MINES IN 1901.

By OUR SPECIAL CORRESPONDENT.

The past year has seen great activity in the development of the mining districts of San Miguel County, and the work done is more important in revealing the permanency of the gold and silver veins of the eastern portion of the county than that of any former year. The older mining companies have shown increased activity in developing their properties and by greater milling facilities they have made the output the largest on record. Transfers of mining properties within the county have been more numerous and more generally distributed than in any previous year. Individual sales in the past, notably those of the Smuggler-Union and Tomboy, have exceeded the total amount of the 1901 sales, but in no single year has the number of actual sales been so large. The following list comprises all the transfers of importance:

Carribean, Montezuma.....	\$350,000
Ophir Consolidated (purchases).....	200,000
San Bernardo.....	200,000
Alta Mines.....	175,000
Contention.....	100,000
Argentine.....	60,000
Crown Point.....	40,000
Fraction.....	25,000
Andrus.....	17,500
Champion and Chieftain.....	15,000
J. N. W., Jr.....	8,500
Total.....	\$1,191,000

These sales were in every instance made to parties who purchased for the sole purpose of developing profitable producers, and on each mine work is being done with that end in view.

While the past year has been one of more than usual activity and prosperity, it has been affected by disastrous occurrences. One of these was the strike of the Miners' Union at the Smuggler-Union mines on May 1, which kept that great property tied up until July 5, and was only settled after a bloody encounter between union and non-union men on the morning of July 3, which resulted in the killing of four men and the wounding of several others. This incident was thoroughly ventilated at the time in the daily press, and it is needless to refer to it at length. The amicable adjustment of all questions of wages and hours of labor in the mines by an agreement between the mine managers and the Miners' Union, to cover a period of three years, will, it is believed, insure harmony that will never again be disturbed. Another and more serious disaster occurred on the morning of November 20, when the buildings at the mouth of the Bullion tunnel, through which the mines of the Smuggler-Union Company are almost wholly worked, together with the terminals of the tramways to the mill at Pandora and to the adit level on the Sheridan, were totally destroyed by fire. Of the men in the mine when the fire started 24 were suffocated by smoke. The calamity in all probability will never be duplicated in this State, for the means that can prevent such fatalities will doubtless be applied to every mine.

**Smuggler-Union Mining Company.**—This great enterprise during 1901, as in former years, has led in the acquisition of new properties, in the development of those under control, in the installation of additional equipment, and, but for the unfortunate occurrences mentioned, would have exceeded in output any other single mining enterprise in this district. Its assessed valuation of \$470,150 is not equalled by any other mining corporation in the State. Its gross output for 1900 of \$837,500 will not be equalled by the 1901 output, but the developments of the past year

ensure a future annual output largely in excess of that for 1900. It has acquired by purchase the Contention Group of gold properties on Bear Creek and connected these mines with its mills at Pandora by an improved Bleichert tramway over 15,000 feet long. Besides this it has entirely built the older of its two stamp mills at Pandora, enlarging it from 60 to 80 stamps and equipping it with modern concentrating machinery. The company has also constructed a cyanide plant of 98 by 225 feet, with a daily capacity of 400 tons of tailings that can be put in operation when the burned buildings and tramway terminal at the mouth of the Bullion tunnel are rebuilt. In the mines a body of rich gold-bearing quartz has been opened on the old Pandora vein by a drift from the Bullion tunnel. This ore body can produce 200 tons per day in addition to the ore bodies of the Smuggler vein proper. There are now recorded with the County Clerk title deeds in the name of this company to 46 claims, of which a small portion only are placer claims. Besides this the company is in possession of nearly as many more unpatented claims. The reconstruction of the destroyed buildings and tramway terminals at the mouth of the Bullion tunnel is progressing with all possible dispatch. It is hoped that the tramways may resume operations by the first of the year, but it will require at least three months to repair the damage fully. In the meanwhile milling is seriously curtailed. The operations of the past year may be summarized as follows: New development, extending drifts and sinking shafts, 3,500 feet; tons of crude ore milled, 106,389; tons of crude ore shipped to smelters, 1,246; tons of concentrates (dry weight) shipped to smelters, 9,546; ounces of gold bullion shipped to mint, 23,799. Based upon values received in former years, the gross value of the output may safely be placed at \$833,924, a shrinkage of less than \$4,000 from 1900. Mr. Arthur L. Collins is manager at Telluride.

**Tomboy Gold Mines, Limited.**—This company has held through the year its distinction of being one of the largest and most profitable gold producers in the United States. The company has acquired by purchase lode claims carrying the Argentine vein, noted as a gold bearing deposit from its discovery in 1878. The purchases include the Argentine No. 1 and No. 2 lode claims, the Fraction and Red Cloud claims and the Argentine No. 1 and No. 2 mill sites. Development has been steadily prosecuted under Manager John Herron to open the veins as extensively as possible, and comprises over 4,000 feet of new work on the Tomboy Mine proper, 2,000 feet on the Argentine and 1,000 feet on the Cincinnati, which also carries the Argentine vein. Concentrates shipments for the year amount to 5,000 tons. Shipments of gold bullion have been in excess of 49,000 ounces. The value of the concentrates and gold bullion shipped during the year amounts to over \$800,000. So efficient has been Mr. Herron's management that the company's Board of Directors, at a recent meeting at the home office in London, voted him a testimonial of £2,000, as an expression of their appreciation. In the coming year the company proposes to build a new mill with necessary bunk and boarding houses, stables, shops, store rooms, etc., involving the expenditure of at least \$150,000.

**Butterfly-Terrible Company.**—The properties belonging to this company are situated on the western extremity of Yellow Mountain adjoining the holdings of the Ophir Consolidated. This company has been actively developing its mines and milling ore at its plant near the Rio Grande Southern Railroad. During the year 940 feet of new work have been completed, divided into 500 feet of raises, 360 feet of drifting and 80 feet of winzes. Other work has been the putting in of 1,200 feet of pipe line conveying water from Wilson Creek to the mill flume from Howard Fork, the building of an addition to the mill, in which will be installed a steam plant, and the putting in of a compressor plant for No. 3 tunnel. The company's mill has treated 14,825 tons of ore, 80 per cent of its value being free gold, the remainder being in concentrates. The net results of the shipments, both gold and concentrates, after deducting



freight, smelter and express charges, is \$96,678; and from this sum, after deducting mine and mill expense, the company has paid four quarterly dividends and carries in its treasury a reserve of several thousand dollars.

**Carribeau-Montezuma.**—This, one of the oldest and most extensively developed mining properties in Ophir District, has been sold within the past few months to an Eastern syndicate that has determined to erect a large milling plant provided with the most modern concentration appliances. The present manager, Mr. Charles S. Newton, who has had charge of the property since 1890, has prosecuted a system of development that has opened the property to a greater extent than any other mine in the district. It has not been the policy of the company represented by Mr. Newton to make any large output of ore, consequently the milling equipment has been of the most modest character. A 10-stamp mill has, however, been treating ore, taken from development mainly, and this plant has returned a profit of from \$3,000 to \$5,000 per month since it started. The output for the year has been 190 tons of concentrates per month, or a total of 2,080 tons, with an average value of \$75 per ton, or a total value of \$156,000, of which nearly or quite one-half has been net profit. The mine has been opened to a depth of some 1,300 feet by 12 levels on the vein. All the workings carry mineral and with the construction of the new mill the property cannot fail of becoming one of the largest and most profitable producers near Ophir.

**Liberty Bell Gold Mining Company.**—This company, whose big 80-stamp mill with its adjacent cyanide plant, is located about one mile from Telluride, has been busy the entire year. The mines are situated at the head of Cornet Creek in the ridge dividing Cornet from Marshall basins. The ore bodies have been uniformly of large size with a marked evenness of gold and silver values. The mines are connected with the mill by an improved Bleichert tramway between two and three miles in length. The company employs about 100 men in its mines and sufficient force in the mill and cyanide plant to enable work to go on steadily. The year's output is given authoritatively as follows: Gross tonnage mined, 69,000; dry concentrates shipped, 1,030 tons; gold bullion shipped to mint, 21,717 ounces; cyanide bullion shipped, 36,316 ounces; new development, 2,500 feet. The value of the output of the property for the year is in excess of \$600,000. Mr. Arthur Winslow is general manager and consulting engineer at Telluride and Mr. Charles A. Chase superintendent in charge.

**Ophir Consolidated Mining Company.**—This company's holdings in this county embrace 71 contiguous claims, lying principally on the north slope of Yellow Mountain, in Ophir District. The Butterfly-Terrible on the west and the Carribeau-Montezuma on the east of this company's holdings have been extensively developed and have been profitable producers for a number of years. During the past summer the Ophir Company built a 20-stamp mill near the line of the Rio Grande Southern Railroad, which started work about September 10 by power furnished by the Telluride Power Company. Since that date the mill has steadily reduced 75 tons of ore daily. The ore concentrates approximating one ton into five car lots, of which from 35 to 40 are shipped monthly, show by smelter returns values from \$350 to \$500 per car. Four cars of crude ore sorted out on the crusher floor are also shipped monthly that show an average value of \$400 per car. A recent ore discovery has made it necessary to provide larger facilities and work on the foundation for an addition of 30 stamps to the present mill will soon begin. The new vein is from 8 to 16 feet wide between walls, the vein matter being free milling gold quartz, with an average value of \$10 per ton. With its present limited milling facilities the company is making a profit of \$9,000 per month and a larger mill and output will greatly increase this.

**Telluride Power Company.**—This company has practically developed and utilized all the water power of the Upper San Miguel River and is at present driving a tunnel some 1,500 feet long through the moun-

tain ridge separating the Trout Lake Basin from Lake Hope, the object of the tunnel being to take Lake Hope and convey its waters to Trout Lake, its main storage reservoir. From Trout Lake some 10 miles of flumes supply the generating stations at Ames and Ilium. Steel pipe lines with heads of 920 feet and 520 feet respectively lead the water to the Pelton wheels at these stations, which are connected to poly-phase alternating generators. These generators supply step-up transformers, which in turn supply to the line a 3-phase current at 10,000 volts and 60 cycles. At the motor stations reducing transformers are used feeding the induction motors in the mines and mills. This company is also furnishing Telluride and the outlying districts several hundred horse-power in arc and incandescent light. Considering the rugged and precipitous mountains over which the lines of this company are carried, its success is remarkable. Several of the lines cross the range at an elevation of over 13,000 feet and the construction entailed great labor and expense. Seventy-five miles of transmission lines and 50 miles of telephone lines are used in transacting the business of this company, covering most of San Miguel and Ouray counties. Among their customers are all the prominent mines and mills in both counties, the Tomboy, Smuggler-Union, Liberty Bell, Camp Bird, Contention, Bear Creek, Nellie, Thomas, Four Metals, Alta, Gold King, Ophir Consolidated, Keystone Placer, Japan, Sheridan, Columbia, Ruby Trust and others. The district at present takes about 2,500 horse-power; the capacity of the stations at Ames and Ilium is 4,000 horse-power. An ample provision for the expansion of milling facilities is anticipated in the near future.

### THE METAL MINING INDUSTRY OF UTAH

FOR 1901.

BY OUR SPECIAL CORRESPONDENT.

A most gratifying showing has been made by Utah mines for the year just closed and there is every probability of a number of new producers being added the coming year. The following is an estimated monthly statement of the ore and bullion settlements in Salt Lake City; there have been some ores treated in the smelters in the Salt Lake Valley from Nevada and Idaho which are included:

1901.	
January.	\$1,783,908
February.	1,800,663
March.	1,729,097
April.	1,758,880
May.	1,712,768
June.	1,830,350
July.	2,009,535
August.	2,105,670
September.	1,917,815
October.	1,936,437
November.	1,794,000
December.	1,950,000
Total.	\$22,329,123
Bingham Consolidated Mining and Smelting Company.	2,283,221
Utah Consolidated Mining Company.	1,983,292
Consolidated Mercur, 12 months.	1,500,000
Grand total.	\$28,095,535

**Juab County (Tintic District).**—The principal producers were the Ajax, 54 cars; Alaska, 6; Bullion Beck, 184; Boss Tweed, 8; Carisa, 377; Centennial-Eureka, 1,213; Dragon Iron Mine, 3; Eureka Hill, 23; Eagle and Blue Bell, 12; Godiva, 84; Gemini, 446; Grand Central, 375; Lower Mammoth, 156; May Day, 106; Mammoth, 456; South Swansea, 129; Swansea, 110; Star Consolidated, 54; Tesora, 135; Undine, 6; Victor, 6; West Morning Glory, 4; Uncle Sam Consolidated, 129; Yankee Consolidated, 76; grand total, 2,754 cars, averaging 25 tons to the car; add to this about 200 cars for December (not included).

The Eureka Hill Mill shipped 15 cars concentrates; the Mammoth Mill, 94 cars concentrates; Tesora Mill, 59 cars concentrates; May Day Mill, 2 cars concentrates, making a total of 170 cars, averaging 30 tons. The Eureka Hill forwarded 38 bars bullion and the Mammoth 54 bars bullion, making a total of 92 bars for the year.

A great many companies and private individuals

are developing properties in the Tintic District, and the following prospects are likely producers in the near future: La Reine, Tetro, Little Chief, Morning Glory, Showers Consolidated, New Imperial, Rabbit Foot, Scranton, Ridge & Valley, Dagmar, Old Colony, White Cloud, Joe Bowers, Old Susan. All these are being systematically developed and some have very good indications.

The Rio Grande Western Railroad hauled the greater portion of the ore to the Salt Lake Valley smelters, the total tonnage of silver and lead ore handled by that line being 62,981 tons. Iron ores to the amount of 12,035 tons were also handled.

The Bullion Beck, the Grand Central and the Mammoth mines have been mixed up in litigation most of the year; the courts have not yet straightened out matters and the production has not been as great as it will be in the future.

**Beaver County.**—The past year marks an epoch in the history of mining in this county. After about 20 years since the discovery of the Horn Silver and other great producers a renewal of activity began with the entrance in the field of A. B. Lewis, Samuel Newhouse, the Franklin Syndicate, a Montana syndicate, and many private individuals, who are chiefly opening up the extensive copper-bearing zone. The only new shipper to the Salt Lake Valley smelters is the O. K. Claim of the Majestic Company where most of that company's money has been spent in development. This claim has been opened up to the 400-ft. level and shows the same rich ore that appears on the 300 and up to the surface. About 23 cars of ore running about 40 per cent copper have been shipped from development alone and the management reports some 10,000 tons of the same ore in sight.

The Cactus, purchased by Mr. Samuel Newhouse, has a large quantity of copper ore developed and a systematic campaign is going on. A mammoth concentrating plant is to be erected at the mine, plans and specifications for which are now in the hands of Mr. J. M. Callow, an authority on concentration, who has tested the ores at his laboratory in Salt Lake City.

The Copper Ranch, now being developed, is reported to show a body over 100 feet wide of good grade milling ore, carrying copper, gold and silver. Among the many other active propositions are the Ben Harrison, Skylark, O. K. Extension, Old Ben, Imperial, Washington, Harrington & Hickory Copper King, Old Hickory, Montreal, Milford and Butte and Beaver companies, many of which will be among the producers in 1902.

The Horn Silver Mine at Frisco, 256 miles south of Salt Lake City, on the Oregon Short Line Railway, has shipped during the year 8,400 tons of first-class ore and 3,150 tons of concentrates, the contents being 601,128 pounds copper, 6,437,352 pounds lead, 283,728 ounces silver and 500 ounces gold.

Another big enterprise that will mean a great deal to Beaver County is a power plant to be erected in the Beaver River, above Beaver. The enterprise originated with Col. Henry Altman, who has induced Mr. A. B. Lewis to join him. Engineers have been over the route, a distance of 30 miles. Col. Altman says it is possible to develop a 500-h. p. at the site selected and work is to start at once. The power is to be used for lighting the towns and for use at the mines.

**Tooele County.**—This large county includes the Ibapah or Deep Creek District, and Mercur, Ophir and Stockton camps, besides many scattered mines, about which it is hard to gather definite information. Farthest west, close to the Nevada boundary, is the Queen of Sheba, a gold mine worked by the Rockledge Brothers. The 10-stamp mill is regularly crushing a clean quartz carrying about \$12 in gold and the mine is looking well. To the east the Midas Mine, owned by Messrs. Grant, Chipman & Dern, has a free milling and cyanide gold mill treating ore running about \$17. The plant has just been erected by the Salt Lake Hardware Company, of Salt Lake City. In Fish Springs Mountains in the desert 25 miles east are located the Utah and Galena mines, which have produced some of the highest grade lead and



silver ores in the State. The Utah has shipped by team to Oasis on the Oregon Short Line, a distance of 75 miles, an average of 50 tons per month during the year and is looking well. The Galena has done much development and has not shipped so regularly. There are other good prospects in the mountains and with railroad facilities there would be many producers. From the Dugway Mountains further east towards Stockton very little ore has been shipped, but a great many properties are being worked and some good copper deposits have been discovered as well as silver and lead veins. Stockton is close to the narrow guage line running out of Salt Lake City, via Garfield Beach and is one of the old camps of the State. The largest mine there is the Honorine, owned by P. L. Kimberly, W. G. Filer, W. F. Snyder and others. A large sum has been expended in development. The company has a complete hoisting and pumping plant and is sinking a 3-compartment shaft 650 feet. When this is completed regular shipments will start. The ore bodies are reported among the largest in the State. The other mines at Stockton are the Cygnet, Silver Coin, West Argent, Galena King, besides others. The camp has been troubled by water in the lower levels and the production so far has all come from above water level.

In the Ophir District close to Stockton is the Ophir Hill Mine, owned by Senator Clark. The ore is low grade. The regular shipments average about 1,500,000 pounds of concentrates per month to the smelters in Salt Lake Valley. The Mono Mine, the Hidden Treasure and the Utah Queen, in Dry Cañon, are all regular shippers. There are also the Brooklyn, Plymouth Rock, Montana Consolidated and others actively worked that may be heard from shortly. At Mercur the Consolidated Mercur is the principal proposition at present. This mine is reported looking exceedingly well and the mill is said to be working at a good profit. During the year 282,000 tons of ore were treated and 72,222 ounces of gold were forwarded. The management has done much development during the year. An average of 520 men are employed in the mines and mill. The Northern Light Mine near Mercur has men on development work seeking the continuation of the veins from which so much rich ore was shipped in the earlier days. The Chloride Point and the Hercules adjoining are not working. At the Sunshine end of the Mercur District the Sunshine Mine is again being worked, and if gold values can be successfully extracted another producer will be heard from. The Overland Mine is now in the hands of a receiver.

Nothing is doing at the West Dip, where the Omaha, Daisy and La Cigale mines are located. These properties caused much excitement a few years ago, but the cyanide mills erected on the two latter properties were complete failures, and the ores in this district await some new process of extraction.

**Piute County.**—On Gold Mountain the principal mine is the Annie Laurie, owned by the Western Exploration Company, of which Mr. Walter G. Filer is president and manager. It is now a great mine and is well developed. The ore is worked by a cyanide mill that treats about 150 tons per day and has produced \$401,391 during the year, about 20 per cent of the values extracted being silver, the balance gold. About 125 men are employed in the mine and mill. The management contemplates enlarging the mill.

Among the other properties in this section are the Sevier, Bluebell, Banner, Bald Mountain, June Bug and Park, all of which are being developed. Some excellent ore is being extracted and this district is coming to the front as a gold producer.

**Iron County.**—In the Stateline District, in the southwestern part of Utah are located the Ophir, Johnny, Margaret and Alice mines and many prospects of considerable merit. Just across the line in Nevada is the Horseshoe, owned by A. W. McCune. Its cyanide mill makes regular shipments. The Ophir Company has just started its cyanide mill after an expenditure of about \$80,000 in development, etc. No returns have yet come to hand for the present year. The company is an Eastern one and is represented by Messrs. Effinger, Jeffs & Lathrop in Utah, the offices being in Salt Lake City.

The Johnny is owned by Salt Lakers. It has paid its way with a small stamp mill from the start and has shipped several cars of high-grade gold and silver ore to the Salt Lake Valley smelters. The Margaret adjoining, also owned in Salt Lake, has done considerable development. This county is also noted for the immense deposits of iron ore near Cedar City. There are also coal fields and plenty of water, so that there is a chance for a great iron industry when a railway to Cedar City from the Utah-California line is completed. There is considerable activity in mining around Cedar City, the Big Fourteen, Burro, Utah Spar and other groups of claims are being developed, showing some good copper and gold, and silver and lead ores.

**Summit County.**—Park City, situated about 30 miles from Salt Lake City on the Rio Grande Western Railroad, is the greatest mining camp in the State. The following are the shipments for the year ending December 1, the ores being sampled by the McIntosh Sampling Works, of Park City:

	Anchor.	Daly.	Silver King.	Ontario.	Daly West.	Quincy.
December, 1900, pounds.....	1,910,210	.....	4,231,880	928,580	4,427,380	.....
January, 1901, pounds.....	2,936,180	.....	5,176,370	1,441,860	4,826,570	.....
February, " " .....	2,602,370	.....	4,919,780	1,170,120	5,014,970	946,000
March, " " .....	1,214,890	.....	4,716,670	302,100	4,612,940	.....
April, " " .....	1,309,650	354,500	5,385,830	929,020	5,109,050	.....
May, " " .....	1,755,030	206,000	5,103,090	4,189,880	5,235,400	491,870
June, " " .....	1,800,230	.....	2,067,140	4,116,860	5,453,660	5,410,860
July, " " .....	1,519,010	315,360	917,020	3,865,780	6,026,150	5,649,890
August, " " .....	2,041,010	337,300	256,520	6,215,510	6,241,200	6,546,880
September, " " .....	1,763,080	70,300	195,030	6,001,910	6,774,700	6,208,980
October, " " .....	1,730,720	103,180	245,670	5,865,070	5,489,690	6,423,830
November, " " .....	1,681,470	.....	177,550	6,207,530	5,775,710	5,341,530
	22,263,850	1,386,640	33,537,550	41,235,120	64,987,420	37,019,910

The Quincy did not begin shipping regularly until May, 1901. The Silver King, since December 1, 1901, has sampled its ore in its own sampler.

Among the many developed properties around Park City are the California, Comstock, D. & M., Silver Bell and Thaynes Canyon Consolidated, in Thaynes Canyon, of which the California is the only producer. Its mill is being enlarged. The management has shipped something like 1,833,990 lbs. of concentrates during the year and expect to increase the output the coming season.

The Snake Creek District south of Park City has been very active this year, and the following properties will likely join the regular producers if indications count: St. Louis and Vassar, Wolverine, Boulder Basin, Bonanza Consolidated, J. I. C., Daly-Judge, Superior. Some excellent showings have been made and the outlook is encouraging.

The Blue Ledge District has the Valeo Mine, which is under lease to Mr. Boyle, who has sent out about 7,000 tons of copper ore to the Salt Lake Valley smelters by way of Heber. In close proximity are the East Valeo, Ramshorn, West Valeo and other groups, in the prospective stage at present. Encouraged by the great showing of the Quincy, several nearby properties have been very active during the latter part of the year. The Little Bell Group, purchased by Mr. Solon Spiro and associates, is being worked in first-class shape. Good buildings have been erected and machinery installed. The shaft is now down 350 feet, where drifting in the contact is going on. The same men own the Lucky Bill Mine, east of the Little Bell, and well equipped with hoist, etc. It is to be worked shortly. The Wabash, Nail-driver, New York and Bogan are all being developed. The Creole Mine, at one time a most promising prospect, is again under development. Two men are taking out ore from a vein 20 to 30 inches wide that promises well.

**Salt Lake Valley Smelters.**—These plants are situated about 5 miles south of Salt Lake City on the Oregon Short Line and Rio Grande Western Railroads.

The Germania Smelter of the American Smelting and Refining Company, Mr. T. R. Jones, Utah, manager, and Mr. J. H. Tucker, superintendent, has treated about 11,000 tons per month. About 450 men are employed. A new plant is under construction to have a capacity of 1,000 tons per day. It is expected to be ready about next April, and will also be a custom smelter. The outlook for the mines of the State leads the company to more than double its capacity

The Highland Boy Smelter is the property of the Utah Consolidated Gold Mines, Limited. Mr. R. T. White is superintendent. The company has treated 70,000 tons of ore during the year and has shipped east 10,276,676 lbs. of copper-gold and silver bullion. About 215 men are employed. The ores have all come from the company's mine at Bingham.

The Bingham Consolidated Mining and Smelting Company's plant began work on February 1, and simply produces matte containing gold, silver and copper. The company has treated an average of 450 tons of ore daily and has shipped product containing 10,446 ozs. gold; 397,516 ozs. silver and 3,981,412 lbs. of copper to Great Falls, Mont., and the Highland Boy Smelter for refining during the year. About 300 men are employed.

The United States Mining Company's plant under construction is to have a capacity of 1,000 tons per day. Mr. George K. Fischer is the chief engineer of the works.

In addition to the plants now being built another

is contemplated by Mr. Samuel Newhouse to treat the ores from his mines in Beaver County and at Bingham.

**Salt Lake County.**—Bingham, the old reliable camp, 26 miles from Salt Lake City, is reached by the Rio Grande Railway. Most of the ore goes to the smelters in Salt Lake Valley. The Utah Consolidated Company's mine, known as the Highland Boy, was the largest shipper during the year, forwarding about 70,000 tons. The ore, which is conveyed to the railway by an aerial tramway, about 5 miles long, carries gold, silver and copper. The United States Company's mines, comprising about 1,000 acres, are being developed under the management of Mr. A. P. Mayberry, about 70 men being regularly employed. The St. Joe Mining Company owns about 300 acres under development and some extensive ore bodies are reported opened. The Dalton and Lark Group, now owned by the Bingham Consolidated Mining and Smelting Company, is also being developed and a large quantity of ore is exposed in the workings. The Rio Grande Western Railway hauled 182,533 tons silver-lead ore and 55,747 tons copper ore from this camp to the Salt Lake Valley smelters during the year.

The Redwing Group of claims close to the railway also ships to the Salt Lake Valley smelters. On the Boston Consolidated, Vespasian and Hoogley, York and Dana, Maxwell, Yosemite, Butterfield and other groups in this camp considerable development is being done, showing some good ore bodies. There are also many small mines which ship ore and concentrates weekly to the smelters, the principal ones being the Acme, Tiewauke, Silver Cord, Last Chance, Ben Butler, Commercial, Phoenix, Bully Boy, Zelnora, Columbia, Ashland and Butterfield.

There are three or four mills in the camp continuously working. The Dewey is entirely a custom mill and does excellent work. The Butterfield Company has its own mill. The Rogers Mill has till recently been a custom mill, but has been sold to Colonel E. A. Wall and is to be used for experimental tests on the mines he is opening.

Alta in former days had some good mines, including the Emma and the Flagstaff. This is a bad winter camp, as the snow lies on the mountain until late in the spring. The Grizzly and Lavina mines have produced a nice quantity of ore during the summer and a great deal of exploration work has been done. The City Rocks, the Oregon, Regulator and other mines in the camp have sent ore to the Salt Lake Valley smelters, and a great deal of work will be done during this winter.



**Salt Lake City Sampling Works.**—The Conklin Sampling Works from December 1, 1900, to December 1, 1901, sampled 70,395,770 lbs., or 35,198 tons of ore. The largest tonnage handled in any one month was 8,734,570 lbs. in November. The smallest amount was 3,542,870 lbs in February.

The Taylor & Brunton Sampling Works, in the Salk Lake Valley, sampled in 1901, 132,979 tons.

#### A REVIEW OF PROGRESS IN THE CYANIDE PROCESS DURING THE YEAR 1901.

By J. S. C. Wells, Ph. D.

The cyanide process has made very decided progress during the past year, especially in this country and in Canada.

A large number of plants have been erected and although many of them are of small capacity, yet there are some of considerable size, notably the new Homestake plant, with a capacity of 1,200 tons per day and the Smuggler-Union plant of 600 tons daily.

The slimes problem seems to have been very successfully solved in several works, the process used in almost all cases being some modification of agitating and settling.

A good example of dry crushing and slimes treatment is that of the Cochiti Gold Mining Company, of Blaine, New Mexico, a description of which was given in the *ENGINEERING AND MINING JOURNAL* January 19, 1901.

A few mills using wet crushing with cyanide solution in the mortars are in operation and the results are said to be satisfactory.

No improvements in the precipitation of gold and silver from cyanide solutions have been developed and in this country the process of precipitation with zinc shavings appears to be the favorite, although zinc dust is being used successfully by several large mills.

The Waldstein or De La Mar patent covering the use of the latter substance has been declared invalid by the United States District Court of Idaho, and it is probable that the use of this method will increase for it has some decided advantages over zinc shavings, yielding a much finer bullion and at no greater cost, and the precipitation seems to be rapid and complete. The chief difficulty is in making it a part of a continuous process.

The following mills treating in all over 3,000 tons per day are using zinc dust for the precipitation of the gold: Homestake Mining Company, South Dakota; Montana Mining Company, Montana; Republic Mining Company, of Washington; De Lamar Mining Company, of Idaho; De La Mar Mining Company, of Nevada; Chainman Mining & Electric Company, of Nevada; Consolidated Mercur Company, of Utah.

The price of zinc dust is \$6 to \$7 per cwt., and the amount used is from 6 to 9 ounces per ton of solution.

The progress of cyaniding is summarized by States as follows:

**California.**—Cyaniding in California is making steady progress, there being several larger plants in operation as well as a number of small ones.

The California King Mines Company has recently made a contract for a new mill to be erected at Pico, 20 miles north of Yuma, Ariz. Its capacity is to be 1,000 tons per day. The ore will be crushed by rolls to 20 mesh size and treated in 10 cyanide tanks 40 feet diameter by 5 feet deep. After leaching, the tailings will be sluiced out through gates in the bottom. Below the leaching tanks will be a series of gold solution tanks from which the solutions will go to the zinc boxes for precipitation.

At Hedges, 25 miles northwest of Yuma, The Golden Cross Mines have a 140-stamp mill and large cyanide plant.

Besides these two large plants the following mines are reported as having erected cyanide plants during the year:

Calaveras County. Keystone, 20 tons, and Cala-

veras Group, the capacity of the latter said to be large.

Eldorado County. The Vandalia Mine is said to have a plant of 400 tons capacity.

Kern County. At the Exposed Treasure and St. John's mines small plants have been erected.

Mariposa County. The Hite Mine has a plant of 100 tons capacity.

San Diego County. The American Soil, near Ogilby, has a new cyanide mill of 200 tons capacity. The ore is crushed by Cornish rolls.

Trinity County. Headlight 200 tons, Golden Jubilee 20 tons.

Tuolumne County. At the Eagle-Shawmut and Densmore new plants have been erected.

Shasta County. Mount Shasta Company, 50 tons. Siskiyou County. Golden Jubilee, 50 tons.

An example of what may be done by coarse crushing is given in the Cummings Mine, near Callahan's, Siskiyou County. The gold in the ore is in an extremely fine state of division and by amalgamation yields only from 13 to 17 per cent. The dry crushing plant which was installed was discarded after several months' trial, owing to the large amount of fines produced making the pulp so slimy that it could not be leached. It was then decided to try leaching the ore after it had been crushed to pass a grizzly set with bars 1 inch apart; the greater part of the material however was 0.25 inch or finer. The consumption of cyanide was 0.5 pound per ton of ore and the time of treatment was from 72 to 90 hours, giving an extraction of 80 per cent. The ore is oxidized iron pyrites.

**Colorado.**—No very large mills have been built during the year, although the Smuggler-Union Mining Company has one under construction that will treat 600 tons of tailings per day. It will probably be in operation early in 1902. The process will be similar to that used at the Liberty Bell, having the collecting vat placed above the leaching vat, using zinc precipitation, etc.

The new Dorcas Pneumatic Cyanide Mill at Florence has a capacity of 120 tons per day. The ore averaging \$20 in value passes through crushers and coarse rolls to the sampling room, thence through a revolving dryer and through two sets of finishing rolls which crush it to 24-mesh size. The finely crushed ore is then roasted in a Holthoff-Wetley furnace, the roasted product passing to the leaching tanks. There are six of these tanks 30 feet in diameter, 4.5 feet deep, and fitted with air pipes in the bottom for the introduction of air during the leaching. The air is supplied at a pressure not exceeding 5 pounds, about 1 cubic foot of air per minute to each ton of ore being sufficient for agitation and oxygenation. The treatment generally lasts five days and leaves a value of about \$1 per ton in the ore. The residue is then sluiced out and concentrated on Wilfley tables. The tailings after this treatment average about 40 cents per ton. The tanks are filled by a conveyor, and as soon as the bottom of the tank is covered with pulp a solution containing 10 pounds KCN per ton is run in gradually, the pulp at the same time continuing to flow in until the tank is full. The air is then turned on gradually and is kept on until the pulp shows an extraction of at least 90 per cent. Whenever the air comes up unevenly through the charge the ore has to be stirred by men with iron rods. This generally requires about 30 hours. The air is then shut off and the pulp allowed to settle for one hour. Percolation is then begun and the strong solution run off as quickly as possible, followed by a weaker one of 5 pounds KCN per ton. This operation is continued until the tests of the solution show only traces of gold. Water is then added to displace the KCN solution. The loss in cyanide is stated to be less than 1 pound per ton. The dust resulting from the dry crushing is collected and treated with cyanide, without previous roasting. From dust assaying \$51.20 per ton the tailings only contained 80c. per ton. It is added to the roasted ore in the leaching tanks, 3 tons to each tank spread evenly on top of the charge.

The Peck Cyanide Mill treated Smuggler-Union

and Marshall Basin tailings, and during the year its capacity was increased from 100 tons to 200 tons per day.

A number of small plants have been erected and operated during the past year in various sections of the state.

**Idaho.**—In this State cyaniding seems to have made but little progress, for, with the exception of the mill of the De La Mar Mining Company there are only a few small plants in operation.

**Montana.**—Cyaniding has developed very much in this State during the year. Many new plants have been erected, some of them being of considerable size, notably that of the Empire Company, near Marysville, in Lewis and Clarke County, with a daily capacity of 500 tons, the Montana Mining Company's plant in Deer Lodge County having a capacity of 400 tons per day, and several others, varying from 100 to 200 tons daily. The industry is confined principally to the following counties: Fergus, Deer Lodge, Lewis and Clarke, and Madison. Many of the mills are working on tailings, but in others directly on ore.

The Fergus County ores are well adapted to cyaniding and when crushed so as to pass a 0.25-in. round hole are said to yield a 90 per cent extraction. A large proportion of the ore assays only about \$3 per ton.

The process as carried on in this State is much the same as that in use elsewhere. In many of the mills the method followed is crushing by stamps, amalgamating and cyaniding the tailings. In others the ore is crushed in rolls and then treated directly in the leaching tanks. In some cases the tailings are so slimy that they cannot be treated by percolation, therefore agitation and decantation have been employed with good results.

**Nevada.**—A few new mills have been built in this State during the year, the largest being that of the Chainman Company at Ely, with an estimated capacity of 300 tons per day. This plant was described in the *ENGINEERING AND MINING JOURNAL*, December 7, 1901.

The Ely Mining and Milling Company also has a new plant which went into operation last spring. Capacity, 50 tons.

At Tuscarora the Dexter Gold Mining Company has a plant in operation treating 100 tons per day, and near the same place the Bull Run Mining Company has put in a new plant. The Cuyahoga Company, of Lyon County, has also completed a new mill. The process in use differs at the various mills.

At the Dexter plant, at Tuscarora, where slimy ores are treated, the method, as described by William Magenau, is quite different from that at the Chainman. The ore is crushed with stamps and amalgamated as usual, the tailings then go to settling tanks equipped with Butters and Mein distributors. The settlers catch 51 per cent of the material run into them, the overflow carrying the slimes being run into ponds and settled. As soon as one pond is full the stream is turned into another and the former allowed to dry for several months. The climate is so dry that in this time the upper two or three feet of the material become well baked. It is then put into cars by means of wheeled scrapers and carried to the leaching tanks to be mixed with the sands. As soon as a settler is full of sands they are shoveled into cars through a hole in the bottom and carried to the leaching tanks, where they are mixed with the dried slimes in the proportion of one car of sands to one of slimes. The mixture is leached continuously for from three to five days with a 0.2 per cent solution of cyanide, the solution running in at the top as fast as it runs out at the bottom. Before discharging, a single water wash is given after the charge has been allowed to drain for several hours, or until no more solution runs off. The cyanide solutions go directly to the zinc boxes.

The sands average \$1.57 gold and \$1.70 silver and the slimes \$3.19 gold and \$5.03 silver, and the extraction is 66.8 per cent of the gold and 37.7 per cent of the silver.

The force of men employed to treat 100 tons per day consists of one foreman, who acts as solution tender during the day, one carman, two shovelers, and one night solution tender, the first and last working 12-hour shifts and the others ten.

At the Ely Mine a dry crushing process is used; the ore after passing through a crusher is dried in a rotary furnace and then crushed to 20-mesh size in rolls, from which it goes to the leaching tanks. The ore leaches easily and the extraction is 80 per cent.

*Utah.*—In the Mercur District cyaniding has been active and a large quantity of ore has been treated. The tailings at Manning are being treated and satisfactory results are reported. The Annie Laurise Company, of Piute County, completed a large new plant this year that has been running successfully.

In addition to the plants above mentioned a few small ones have been built.

*New Mexico.*—The Cochiti Gold Mining Co., of Bland, has in successful operation a method of treating the dust from their dry crushing mill. The process was quite fully described by Mr. Chas. S. Hunter in the *ENGINEERING AND MINING JOURNAL* of January 19, 1901. Here 98 per cent of the dust will pass a 100-mesh screen. The process used is agitating and settling, the agitation being effected by steam and compressed air, the latter being under 60-pound pressure. The steam is used to heat the charge, as it was found that the air on expanding cooled it too much. The mixture of air and steam is admitted through 1-in. horizontal iron pipes in the bottom of the tank. The pipes have 0.0625-in. holes in the under side for the escape of the air and steam. In 24 hours 94 per cent of the total values are in solution, using a solution of cyanide of 3 pounds per ton, but only 80 per cent is recovered, due to the solution going to waste in the slimes. To neutralize the acidity of the ore and to aid the settling of the slimes, lime is suspended in a wire basket in the upper part of the tank. The cost of treatment is given as \$1 per ton.

*Oregon and Washington.*—The cyanide process is but little used as yet in either of these States, the only large plant being that of the Republic Power & Cyanide Company in the Republic District in Washington, which is not working at present.

*Cyanide Patent Litigation in 1901.*—A case of considerable interest regarding the use of zinc dust or fume as a precipitant of gold and silver from cyanide solutions was recently decided by the United States District Court for Idaho. The suit was brought by Capt. J. R. De La Mar against the De Lamar Mining Company to prevent the latter using zinc dust as a precipitant, and claiming that such use was an infringement of United States patent No. 607,719, of March 9, 1896, covering certain improvements in the cyanide process. The court decided against the plaintiff and held that the patent was anticipated by prior publications and patents. It is supposed that Capt. De La Mar will carry the case up to a higher court for final decision.

Those wishing to use the process may be interested to know just what are the claims of the patent in question, as well as something of what was known regarding this use of zinc dust prior to the application for the patent.

United States patent No. 607,719, filed March 9, 1896.

"Claim 1. The process of extracting precious metals from cyanide solutions, which consists in treating said solutions with zinc dust, to wit, the herein described material composed of zinc and zinc oxide, in a state of agitation, substantially as described.

"Claim 2. In the process of extracting precious metals from cyanide solutions the use as a precipitating reagent of a definite quantity of zinc dust in a state of agitation, the quantity of said zinc dust being supplied in only a sufficient quantity to thoroughly precipitate the contained metals, substantially as described.

"Claim 3. The process for extracting and recovering precious metals from their ores and which

consists essentially of the following steps: First, subjecting the ore in a powdered state to the action of an aqueous solution of a cyanide; second, supplying to the solution charged with the precious metals that quantity of zinc dust determined to be exactly sufficient to precipitate said metals; third, agitating said solution and said zinc dust until said metals are precipitated, and said zinc dust is absorbed; fourth, recovering the precious metals from the valuable precipitate of the preceding steps by filtration or other process, substantially as described."

Now let us turn to a paper read by Mr. H. L. Sulman before the Institution of Mining and Metallurgy (London) on February 20, 1895. In it, after speaking of the different methods of precipitation in use and describing the requirements demanded of a metallic precipitant, he goes on to say that all the conditions are fulfilled "by the product known as zinc fume. . . . It is a commercial by-product . . . being the condensed metallic vapor in a state of extreme division." "It is an impalpable metallic flour and is seen under the microscope to consist of spheres more or less coated with oxide." This oxide, he says, retards somewhat the precipitating action and he recommends treating the product with dilute ammonia or some similar solvent of zinc oxide, thus leaving the zinc clean. "A small portion of this preparation agitated with a very dilute solution of auro-potassic cyanide permeates the whole volume of liquor rendering it slightly and uniformly cloudy . . . and almost immediately determines the precipitation of the gold." "I have treated considerable volumes of gold solutions of varying strength of cyanide and with an expenditure of zinc fume never exceeding 0.5 pound per ton of ore have obtained precipitates, which seldom contained below 97 to 98 per cent of the gold originally present in the liquor." "When the solutions are rich in metal (or over 0.3 ounce per ton) the addition of zinc fume of from three to four times the weight of gold present has been sufficient to completely precipitate the latter. Very dilute solutions strangely enough require rather more than this."

It will be seen from the quotations given that every claim of the Waldstein or the De La Mar patent is fully and clearly anticipated by the process described by Sulman. The only difference between the two is in Sulman's treatment of the zinc dust with an ammoniacal solution so as to remove the oxide as he says the presence of the latter (the oxide) renders the action of the untreated product somewhat slow as a gold precipitant. From this it is plainly evident that he knew that zinc dust in its untreated state would precipitate gold, but not quite so rapidly as when freed from the adhering oxide.

His United States patent No. 576,173, filed February 25, 1895, also clearly shows that he did not consider it possible to patent the use of zinc dust alone as a precipitant, for all he attempts to cover in his patent is the process for removing the zinc oxide so as to make the zinc more active, and a special form of apparatus in which to make the precipitation. If Dr. Waldstein had had Mr. Sulman's paper before him when drawing up his claims he could not have copied them more closely had he tried.

Aside from Sulman's work it does not seem possible that such a patent could be valid, for even Dr. Waldstein must admit that it is the zinc of the zinc dust that causes the precipitation and not the oxide. Such being the case, in what way does it differ from the ordinary zinc precipitation, except that the zinc is in a more finely divided state, a condition which was well known to be favorable to precipitation?

#### CYANIDING IN THE BLACK HILLS, SOUTH DAKOTA, DURING 1900.

BY CHARLES H. FULTON, E.M.

The condition of the industry is very prosperous, and the process is the dominant factor in the development of the Hills. The ores treated, with the exception of the Homestake tailings, are mainly of the siliceous Potsdam variety. This is quartzite car-

rying from 2 to 6 per cent pyrites in the unoxidized ores. Considerable of the ore is oxidized and is the simplest to treat. But a very small percentage of the values in these ores are free milling. The unoxidized or pyritic ores, are known locally as "blue ores" from the bluish cast of the quartzite. In the Ragged Top District (Preston) where the Spearfish Gold Mining Company's plant and the Deadwood Standard Company's plants are located, the ores occur in the carboniferous, and are mainly a siliceous limestone. The gold seemingly occurs on the cleavage planes of the rock in very fine films, allowing of very coarse crushing. The Potsdam ores, while all of the same general nature and appearance, are still widely different as regards the occurrence of the gold in them. Some have the gold on the cleavage planes, as in the limestone, as at the Wasp No. 2 Cyanide Plant on Yellow Creek, while others, as from Portland and Bald Mountain, have the values very finely disseminated, requiring very fine crushing. This explains the wide difference in the design of plants in the district. A few of the quartzite ores at Yellow Creek carry some antimony in the form of stibnite, however, not sufficient to cause difficulty in cyaniding.

F. C. Smith considers tellurium as being often present in the Potsdam ores; if this be so, no attention has yet been paid to it in cyaniding.

So far all the ores cyanided are treated raw, although one of the new mills is installing a roasting furnace to treat the more refractory "blue ores."

Two methods of cyaniding, exclusive of the Homestake type, are in vogue in the hills—1. Dry crushing by rolls, cyaniding the resulting pulp; and 2. Wet, fine crushing by stamps with cyanide solutions, separating the crushed product into sands and slimes by means of settling boxes, leaching the sands in the usual way, and treating the slimes by agitation and decantation.

Agitation is obtained by pumping from one tank to another by means of a sand or centrifugal pump. The process is similar to that described by Parks as practiced in some of the New Zealand districts. The crushing by rolls in the dry mills varies much in fineness, some of the mills crushing to pass a 6-mesh screen, while others crush to pass a 16 to 20-mesh screen. This is necessitated by the dissemination of the gold. There are two mills using the wet crushing method, one the plant of the Dakota Mining and Milling Company, at Deadwood, and the other the Portland Mill at Gayville, 2 miles from Deadwood. The rest of the mills in operation, as well as those in the course of construction, with the exception of the Homestake tailings plants, are dry crushing.

*The Homestake Company's 1,200-ton Tailing Plant at Lead.*—This plant takes the tailings pulp from the Golden Star, Eighty, and Highland stamp mills. The pulp is conveyed to the cyanide plant in a 10-in. cast iron pipe. On its way it passes through the classifier house, where some of the slimes are separated by means of 8 large sheet iron cone-shaped classifiers. These cones have no upward or rising current, but as the ore pulp is charged by pipe at the center, the sands settling to the bottom and are discharged, while the slimes overflow at the periphery. The sands are then carried to the cyanide plant, where they are fed to 7 additional cones and treated as above described. The slimes overflowing at the periphery are again discarded, while the sands are discharged to 4-compartment jigs of the Harz pattern, which act as classifiers. One cone feeds 4 jigs. The jiggling is done on beds of pyrites concentrates, relatively coarse screens being employed, except in the last compartment. The stroke varies in the different compartments from  $\frac{1}{2}$  inch. to about  $\frac{1}{2}$  inch. The last compartment is widened out in order to compensate for the increased amount of discharge water from which the discharge of carrying the slimes is discarded. The continuous hutch discharge is taken by open launder to the revolving pipe distributors, which fill the leaching tanks, the peripheral overflow of the tanks still carrying off slimes. Lime in the form of an emulsion is added to the pulp launder which takes the jig discharge.



There are 14 leaching tanks, 45 feet in diameter, 9 feet deep, built of California red-wood. The tanks are placed 7 in a row. There is one revolving distributor of the Butters type for each row, being moved from tank to tank by overhead track, as required. To get an even overflow at the periphery of the tank, the top of the staves are grooved to a depth of  $\frac{1}{2}$  inch, and a soft pine tongue is inserted projecting from  $\frac{1}{2}$  to  $\frac{3}{4}$  inch above the top of the staves. This is then easily planed and can be kept perfectly level. It is also readily renewed.

It is the object to charge just as much slime with the sands as possible and still leach in a reasonable time. For this purpose the adjustments are made on the jigs and distributors. The value of the pulp as it leaves the stamp mills is from \$1.25 to \$1.50 per ton. The amount crushed in the mills approximates 2,000 tons per day, while the cyanide mill treats about 1,200 to 1,300 tons per day. The difference, or 700 tons, is discarded as slimes which, while carrying considerable value, cannot be treated in the condition they are in, and must be discarded. The proportion of slimes separated out is about 35 per cent. The sands are leached directly in the filling vats.

Precipitation is carried on by means of zinc dust in five tanks 25 feet in diameter, and 20 feet deep, built of California red-wood. The bottoms are inclined to one side, where a small sump is provided in order to drain the tank perfectly. No gold storage solution tanks are used, the solutions draining from the leaching vats directly into the precipitating vats. The precipitation vats are pumped out by duplex Prescott pumps, the solution going to filter presses made in the Homestake shops. The pulp treated by the mill is of a highly siliceous nature, often however carrying some hornblende, the sulphides being mainly pyrite and pyrrhotite. The extraction made is in the neighborhood of 90 per cent, the cost being between 45 and 50 cents per ton of material treated, probably nearer the latter figure.

*The Dakota Mining and Milling Company's Plant at Deadwood.*—This is a 60-ton wet crushing plant, very recently constructed, being in operation not quite two months. The ore treated comes from Portland and Bald Mountain, is the usual quartzite, with values very finely disseminated. The ore is crushed rough in a No. 2 Gates gyratory crusher, and passes to the storage bin, from which it is fed by suspended challenge feeds to two 10-stamp batteries, having 900-lb. stamps, which crush through 20-mesh woven wire screens. The mortars are double discharge, but as the ore is crushed with cyanide solution (strength 0.1 per cent), some of the rear discharges are closed in order to keep the amount of solution from becoming too large. With both discharges open too much solution is used. The pulp discharge is caught by a launder in front of battery, conveyed to a sump from which it is elevated by a Frenier sand pump (capacity 6,000 gallons per hour) to a distributing box with launders to convey it to the separator boxes, one of which is placed above each sand tank. These separator boxes are 5 by 4 feet in cross section, and 5 feet deep, built in two compartments, each compartment having in the bottom a circular discharge gate, hinged and closing tight against a rubber gasket by means of a long lever. The pulp flows into one compartment, the sands settling to the bottom, while the slimes overflow at one side. When one compartment is filled with sands, the pulp is deflected to the second compartment and the first discharged into the leaching vat below. The slimes flow by launder to the first slimes settling vat where they are allowed to settle. Four pounds of lime per ton of ore are added at the batteries to aid the slimes in settling; the acidity of the ore is very slight.

*Treatment of the Sands.*—The sand vats are of red cedar, 20 feet in diameter and 5 feet deep, arranged in four sets of two each, one below the other for double treatment of the sands. It takes 24 hours to charge a tank by means of the separator boxes. The sands are leached with a strong cyanide solution of 0.2 per cent, followed by weak solution—0.1 per cent—and wash water. They are then shoveled through the bot-

tom discharge gates, to the second vat below and re-treated. The time of transference is 12 hours, and the cost 5 cents per ton. The total time of treatment is 5 days, including charging, transference and discharging, this last named being done by sluicing. The extraction made on sands is 83 to 84 per cent, of which 8 per cent is extracted in the second treatment.

*Treatment of Slimes.*—There are six slimes vats of red cedar 20 feet in diameter, 12 feet deep, and after settling out the slimes from the solution in the first slimes vat the solution is drawn off as close as possible by siphoning, and is passed through the zinc boxes, thence to the barren solution sump tank. Fresh weak solution is added to the settled slimes, and the slimes mixture is then pumped by a sand pump to a second slimes vat, where the operation is repeated as above. The slimes are re-pumped four times, the last time wash water being added instead of weak solution; they are discharged by sluicing after the last settling. An extraction of 88 per cent is made on the slimes, although only about 80 per cent is saved, the balance going out with the slimes, which retain about 100 per cent of moisture. Only one wash water is used, as otherwise too great a bulk of solution is accumulated. The total time consumed in treating a vat of slimes is 6 days. Four 10-compartment zinc boxes are used to precipitate the solution.

*The Cyanide Plant of the Wasp No. 2 Mining Company.*—This plant on Yellow Creek, near Kirk, is a dry, coarse crushing plant, capacity 90 tons per day. The ore is quartzite, the gold being on the cleavage planes, and in the seams and cracks so that coarse crushing only is necessary to make it available for solution. The value varies from \$3 to \$12 per ton, the main bulk averaging about \$4. It is mined very cheaply (85 to 90 cents) by open-cut mining. The mill is built in terraces on a very steep hillside, and the ore is moved through almost entirely by gravity. It is hauled from the mine 750 feet distant in trains of four cars, and charged into the main bin from which it passes to a No. 2 D. Gates crusher over a 4 by 8-ft. grizzly having  $1\frac{1}{2}$ -inch spaces between bars. The undersize and the crushed ore from the Gates go to the storage bin, from which it is fed by Tulloch feeders into one set of coarse Gates rolls 14 by 24 inches, 80 revolutions per minute. The rolls discharge to a stationary inclined 2-mesh screen 7 feet long, 1 foot wide, the oversize from which passes through the finishing rolls 14 by 24 inches, operated at 100 revolutions per minute, and meets the undersize, the combined product being elevated by the one-bucket elevator in the mill to the shaking finishing screens, situated on a level with the coarse rolls. This screen is an inclined shaking  $2\frac{1}{2}$ -mesh screen, 16 feet long and 2 feet wide, the lower half being stationary. Nearly all of the finished product passes a 6-mesh screen, the oversize from which being returned by gravity to the finishing rolls.

The ore is charged from the finished product bin into the four leaching tanks of Oregon fir; each tank is 16 feet diameter, 7 feet deep and of 55 tons capacity. For this purpose a 16-inch belt conveyor is used at a speed of 600 feet per minute. A large 100-ton tank has recently been added, which gives the mill the capacity mentioned above. Tanks are charged in from 2 to  $2\frac{1}{2}$  hours, the cyanide solution being added after the tank is about one-half filled. The strength of the strong solution is 6 pounds cyanide per ton of solution. About 15 pounds of strong solution are run on and usually allowed to stand 3 to 4 hours, then it is drained, a weak solution being added at top to replace it. After this complete replacement it is allowed to stand a short time and then circulated for the balance of the leaching. The weak solution contains from  $2\frac{1}{2}$  to 3 pounds cyanide per ton. About 50 tons of weak solution are used, followed by from 6 to 9 tons of wash water. To neutralize the acidity of the ore and give a protective alkalinity, 6 pounds of lime per ton are added before the ore is dumped into the first bins. The cost of cyaniding is from 85 to 90 cents per ton. The precipitation is accomplished by zinc thread in specially constructed barrels, and

very good results are obtained, the tailings solution having a value of from 4 to 10 cents per ton. The extraction made is from 80 to 90 per cent of the values, and the consumption of the cyanide amounts to about  $\frac{1}{2}$  pound per ton of ore. The precipitates are treated by the usual sulphuric acid method. Zinc dust precipitation in the tanks, pumping the resultant mixture through filter presses, was tried at the mill, but discarded on account of the difficulty in the clean-up.

*The Cyanide Plant of the Imperial Gold Mining and Milling Company.*—This is a new dry crushing mill in course of erection at Deadwood, with facilities for roasting the heavier blue ores. The mill is modelled after the Colorado (Florence) pattern, and is built on the level, and the crushing, roasting and leaching departments are inclosed in separate adjoining building. The entire product is handled automatically by belt conveyors and elevators. The crushing is done by a Blake crusher and Davies rolls, and the screening mostly by rotary screens. The sulphide ores are to be roasted in a Holthoff-Wetley double-hearth furnace, the lower hearth being used for cooling. Ample provision is made for dust collection. The mill has an automatic Vezin sampler, which samples all material passing through the mill. The four leaching tanks are of 3-16-inch steel, 35 feet diameter and 6 feet deep, and all the rest of the tanks of steel, including the zinc boxes.

The following costs of milling are approximately correct, and but little variation from these figures will be found in modern practice. The cost of the wet crushing process per ton is \$2, or a little less. The cost of coarse crushing on lime ores by the Spearfish Company before its plant was destroyed was from 75 to 80 cents per ton. The cost of fine dry crushing and cyaniding has not yet been demonstrated. The old Golden Gate Mill was too small and of too old a type to show modern practice, but as demonstrated there it amounted to from \$4.50 to \$5 per ton when treating a very limited amount. The actual cost, under modern conditions, is undoubtedly about \$2 per ton.

*Cyanide Mills in the Northern Black Hills, December 1, 1901.*—The following list comprises cyanide mills both operative and inoperative, together with those in course of erection: From it will be seen the development of this important branch of gold extraction.

#### Mills in operation:

1. Homestake Cyanide Mill, at Lead, S. Dak., capacity 1,200 tons stamp mill tailings.
2. Portland Cyanide Mill, at Gayville, S. Dak., capacity 60 tons of ore per day.
3. Wasp No. 2 Mining Company's Cyanide Mill, near Kirk, S. Dak., capacity 90 tons ore per day.
4. Cleopatra Mining and Milling Company's Cyanide Mill, on Squaw Creek, capacity 100 tons ore per day.
5. Dakota Mining and Milling Company's Cyanide Mill, in Deadwood, capacity 60 tons ore per day.

#### Mills not in operation:

1. Golden Gate Cyanide Mill (oldest mill in the hills, not modern), closed since September.
2. Shawmut Gold Mining and Milling Company's Cyanide Mill, Black-tail Gulch, near Central City, capacity 30 tons.
3. (Known as Annie Creek Cyanide plant) Cyanide Mill, Annie Creek, capacity 100 tons.
4. Clevenger plant, cyanide, Rapid City, S. Dak., capacity 30 tons, chlorination tailings.

#### Mills in the course of erection:

1. Imperial Gold Mining and Milling Company's cyanide plant, Deadwood, capacity 100 tons.
2. Golden Reward Mining Company's cyanide plant, Deadwood, capacity 200 tons.
3. Spearfish Gold Mining and Milling Company's cyanide plant, Preston, S. Dak., 250 tons; this mill takes the place of the one recently destroyed by fire, which was on the active list before its destruction.

4. Deadwood Standard Mining Company's cyanide plant, Preston, S. Dak., capacity 200 tons.

5. Homestake Central Cyanide Mill, at Gayville, S. Dak., capacity 600 tons of tailings.

6. Little Blue Mining Company's cyanide mill, Alder Creek, near Kirk, capacity 50 tons.

There are several mills projected which will probably be built in the spring. The mills named under the heading "In course of erection," will be completed in two to five months from date unless delayed. Under the head of "Mills not in operation," the Golden Gate Mill will be probably permanently closed, unless it is more modernized. The Shawmut may in the near future increase its capacity. There are rumors of the Annie Creek Mill restarting in the near future. The Clevenger plant, at Rapid City, has exhausted the supply of tailings from the chlorination mill, and is being dismantled.

Aside from the larger plants above stated, there have been four plants along Whitewood Creek operating on Homestake tailings this summer. The old Dakota plant (10 tons) at Central City, an experimental plant, has been at work at intervals. The small mill at Gayville, known as the Parker, Gibbs & Cook Mill, has been at work part of the time. The Deadbroke Mining Company's combined stamp and cyanide mill in Blacktail Gulch, has been experimenting, but is not running at present.

There is a plant also at Mystic, S. Dak., employing a secret electric cyanide process. The mill does not as yet treat ore on a commercial scale. Aside from these, there are two or three smaller plants not at present running.

#### IRON AND STEEL IN 1901.

At the birth of the present century, January 1, 1901, predictions were freely made that before the end of its first year the era of prosperity which began in 1897 would have passed and that the swing of the pendulum would be in the direction of depression if not of hard times. Such prophets have been proved to be false ones. The year 1901 has surpassed all previous records in nearly all branches of industry, and in no case has this been more signally apparent than in the production of iron and steel. Moreover, the year closed with most satisfactory prospects for 1902. The furnaces have contracted for most of their production for the present year at prices ruling at its opening which in nearly all lines are at an advance over the prices at the beginning of 1901. The production of iron in the United States in each of the last three years has been the largest in our history. In 1899 our production of pig iron amounted to 13,620,703 long tons; in 1900 it amounted to 13,789,242 long tons, and from information received from our correspondents and through other sources we estimate the production for 1901 at approximately 15,800,000 or about 2,000,000 tons in excess of the preceding year. The record of increased iron production made by the United States in 1901 was not shared with any of the other important iron-producing nations. The production in both Germany and Great Britain was less in 1901 than in 1900, and this decrease in output was general throughout the European countries.

**Iron Ore.**—The Lake Superior Region continues to be by far the most important source of iron ore supply, and there is little probability of there being any change in this respect for a number of years. In the following table is presented a statement of the shipments of iron ore from the Lake Superior Region to the lower Lake ports, during 1900 and 1901. The rail shipments for 1901 have been estimated at 500,000 long tons:

	1900. Long tons.	1901. Long tons.
Shipments from Lake Superior ports except Marquette.....	12,471,720	13,780,570
Shipments from Marquette and Escanaba .....	6,098,595	6,376,952
Total by water .....	18,570,315	20,157,522
Rail shipments .....	489,078	(a) 500,000
	19,059,393	20,657,522

The receipts at Lake Erie ports in 1901 amounted to 17,014,076 tons, leaving about 3,640,000 tons sent to Milwaukee and South Chicago. To the receipts at Lake Erie ports should be added about 160,000 tons which were imported from the Helen Mine in the Michipicoten District of Ontario, Canada. This mine produced last year about 230,000 long tons, of which about 70,000 tons was sent to Canadian furnaces at Midland and Hamilton, the balance being shipped to the United States.

The production of iron ore outside of the Lake Superior Region may be placed at about 7,500,000 tons making the total iron ore production for the year approximately 28,150,000 tons, accepting the Lake Superior shipments as representing the production of that region. The imported ore will add 1,000,000 tons to this supply.

**Pig Iron.**—We estimate the production of pig iron in the United States during 1901 at 15,800,000 long tons as compared with 13,789,242 long tons in 1900 and 13,620,703 long tons in 1899. This means an increase in 1901 over 1900 of about 2,000,000 tons. According to the statistics compiled by Mr. James M. Swank, General Manager of the American Iron and Steel Association, the production of pig iron in the first half of 1901 aggregated 7,674,613 long tons. How this production compared with the output during the first and second halves of the preceding year is shown in the following table, which also shows the classification of the product according to its uses:

	1900.		Second half		1901.—	
	First half	Second half	First half	Second half	First half	Second half
	Tons.	Per cent.	Tons.	Per cent.	Tons.	Per cent.
Foundry and forge iron.....	2,451,208	32.1	2,066,229	33.6	2,311,401	30.1
Bessemer pig .....	4,461,301	58.4	3,482,061	56.6	4,582,187	59.7
Basic pig .....	581,868	7.6	490,508	8.0	645,105	8.5
Ferro-manganese and speigeleisen .....	148,102	1.9	107,875	1.8	135,920	1.7
Totals.....	7,642,569	100.0	6,146,673	100.0	7,674,613	100.0

It will be seen from this table that while the production during the first half of 1901 was over 1,500,000 tons more than that of the latter half of 1900 it was only a little more than 30,000 tons in excess of that of the first half of that year. But the activity in the iron business during the second six months of last year was greater than during the first half of the year and the production can be safely estimated at over 8,000,000 long tons, exceeding the total production for the years 1889, 1893 or 1894. The bulk of the increased production in 1901 was from the iron centers in the middle west—the Pittsburg District, Illinois and Ohio. There was increased production also in the Southern States, but not to the same extent as in the larger iron-making regions.

One of the interesting features of the industry during the past year has been the enlarged output of basic pig iron for the manufacture of open-hearth steel. The production of basic pig iron in the first six months of 1901 was more than 150,000 tons larger than that of the latter half of the preceding year, and more than 10 per cent larger than in the first half of 1900. A good part of this increased production of basic pig has been due to the important developments at Ensley, Alabama, which include a large plant of Semet-Solvay by-product coke ovens, and a large open-hearth steel plant operated in connection with them. As a result of these developments Alabama's iron industry is no longer confined to the manufacture and sale of pig iron, and before long will figure as an important producer of steel. It is understood that the Sloss-Sheffield and the Republic Iron and Steel companies are contemplating putting up extensive open-hearth steel plants.

Of no little interest to the iron and steel trade has been the conduct of the United States Steel Corporation, which has pursued the policy of maintaining prices at reasonable figures. The demand for iron and steel of all kinds during the latter part of 1901 was so active that marked advances in prices would not have caused much surprise. The steel corporation, however, has evidently determin-

ed that it is better to do a large business at reasonable prices than to restrict production by advancing quotations. It has also earned public confidence by the publication of its semi-annual statement. By these two actions this corporation has done much towards allaying the public fear of and antagonism to industrial combinations, and has undoubtedly given strength to the iron and steel industry.

**Blast Furnace Capacity.**—The enlarged size and increased capacity of the blast furnaces in use in the United States have been the most prominent features of the industry during the last twenty years. The year in which the largest number of furnaces was in blast in the United States was in 1881, in which year 455 furnaces were reported active and the production of pig iron amounted to 4,144,254 long tons. This was equivalent to an average yearly production per furnace of 9,108 long tons. In 1900 the number of furnaces in blast was 232, a little more than half the number in 1881, while the production was 13,789,242 long tons, equivalent to an average production per furnace of 59,437 tons. These comparisons are not exact, but they are sufficiently so to show the general tendency.

**Exports of Iron and Steel.**—According to the reports of the Bureau of Statistics of the United States Treasury Department, the value of the exports of iron and steel and the manufactures thereof, including machinery, from the United

States for the ten months ending October 31, amounted to \$85,912,136, as compared with \$109,492,127 for the corresponding period in 1900, and with \$86,167,205 in 1899. The decrease in the value of the exports last year as compared with 1900, was due principally to the increased domestic consumption, although the average prices for 1901 were somewhat less than they were for the preceding year, taking the entire twelve months.

**Prices.**—The tendency of prices for iron and steel products during 1901 has been in an upward direction, though in few instances, did they reach the high level which prevailed in the early part of 1900. During 1900, however, prices were generally declining, while the opposite has been the rule for 1901. Bessemer pig, which sold at \$25 per ton in January, 1900, has declined to \$13.25 in October and closed in December at \$13.90. Steel billets declined from \$35 in January to \$19.75 in December and have been as low (October) as \$16.75. The price of steel rails was \$35 in January and \$26 in December. Ferro-manganese was as high as \$125 in April, was quoted at just half that figure in December. The record for 1901 shows that Bessemer pig advanced from \$14 in January to \$16 in December; billets advanced from \$19.75 to \$28; steel rails from \$26 to \$28. Ferro-manganese was quoted at \$52.50 at the close of the year.

**Production in Foreign Countries.**—The United States is the only one of the important iron producers in which the output for 1901 was larger than in 1900. In Europe production generally decreased. Germany's production of pig iron for the first ten months of 1901 amounted to 6,516,986 metric tons, a decrease of 403,948 metric tons as compared with the same period in 1900. This decrease was principally shown in the later months and more recent reports indicate that the production for November and December will show a continued falling off so that the total for the year will show a drop of about 600,000 tons from 1900, when the product amounted to 8,351,742 metric tons. The output for 1901 will be, therefore, about 7,750,000 tons.



The statistics of furnaces in blast in the United Kingdom up to the end of October show an indicated decrease of about 10 per cent in 1901 as compared with 1900, when the total output was 8,908,570 long tons, from which it appears that the product last year was approximately 8,000,000 tons. Reports from Russia, France and Belgium indicate a decreased production in each of those countries.

**RAILROAD EXTENSION IN 1901**

According to statistics compiled by the *Railroad Gazette*, the amount of new railway mileage built in the United States (including Canada), during 1901 was approximately 4,518 miles, a decrease of about 300 miles from the record of 4,804 miles built in 1900. No figures of railway building were obtained for Canada in 1900, whereas 658 miles were reported from the Dominion in 1901. This leaves the total for the United States last year, 3,868 miles or 950 less than in 1900. Texas headed the list of States in both years with 313½ miles in 1900, and 537 miles in 1901. Oklahoma was second in importance in 1901 with a total of 398 miles, while third place is taken by West Virginia, with 266.5 miles. Little development was shown by the Eastern States. In New England, for instance, Maine is credited with only 12 miles; New Hampshire, none; Vermont, 18; Massachusetts, 7; Rhode Island, none; Connecticut, none. Among the Middle States, Pennsylvania leads with 102 miles; New York built only 31 miles; New Jersey, 5 miles; Delaware, none, and Maryland, 42 miles.

Against this decrease in new mileage in 1901, may be set the largest output of railway cars ever recorded in any one year. Exclusive of the cars built by railroads in their own shops, the total number of all kinds of cars built last year was 144,267, an increase of 20,161 over 1900, when the output amounted to 124,106 cars. Of the total in 1901 132,591 were freight, 1,949 passenger, 4,755 street cars for use in this country; and 4,359 freight, 106 passenger and 507 street cars for export. In 1900 the total output of the car-building works was 124,106 cars, as follows: 113,070 freight, 1,515 passenger, and 6,091 street cars for use here; and 2,561 freight, 121 passenger and 784 freight cars for export. Of the total of 136,950 freight cars built in 1901, 28,143 were either all steel or had steel under frames, as compared with 18,604 of the same kind in 1900.

The increased car building taken in connection with the decrease in the new mileage constructed indicates that the transportation companies have been giving more attention to the acquisition of rolling stock to handle the business already at hand, rather than extending their lines and putting additional taxes on their equipment.

**THE PITTSBURG IRON MARKET IN 1901.**

By Our Special Correspondent.

The year just closed has been a more satisfactory one to the iron and steel interests than 1900 or the boom year of 1899, despite the big strike of steel workers which curtailed the production of the United States Steel Corporation by thousands of tons. While prices did not reach as high a point as during 1899 the output of the mills and furnaces was greater. The markets began to increase in strength at the opening of the year and prices steadily advanced with the constantly growing demand. The capacity of the mills of large concerns was enlarged, new works were built, but at no time was the production in excess of the demand. The conservative policy of the principal steel interests in preventing prices from soaring to an abnormal figure gave confidence to the consumers, and as a result orders were freely placed for extended future delivery. The mills were kept in constant operation during the entire year, except a number of the plants of the big steel corporation which were entirely closed or operated unsatisfactorily for two months in the summer owing to a strike of the Amalgamated Association of Iron, Steel and Tin-plate Workers. Despite this shutting off of pro-

duction, when the official figures of the output of iron and steel for 1901 are compiled they will show a greater tonnage than any year in the history of the country. There were other annoying features besides the strike last year, one being a car shortage in the last quarter which was more severely felt than in any former year. The demand for iron and steel products in the last month was the greatest ever known for December. The year closed with fully 100,000 tons of finished material at the mills in this district that could not be delivered on account of the car shortage. A flood and a strike of railroad switchmen greatly handicapped a number of mills in this district in November and December.

Higher prices ruled at the close of the year in almost every line of raw and finished material. Pig iron began to advance in February and steadily continued throughout the year, but ruled a trifle higher in March and April than in the succeeding months. Corresponding advances were made in finished material. Several attempts were made during the last quarter to increase prices to a high point temporarily, at least, warranted by an unprecedented heavy demand. Particularly was this the case in structural steel, but in every instance the big steel corporation filed an emphatic protest with the desired effect. It was admitted that higher rates could easily be obtained in almost every line of finished material, but it was argued that buyers would hesitate in placing orders for future delivery, which would result in weakening the market. The policy adopted has since been shown to have been a wise one, as a steady market is assured for at least the first half of 1902. The heavy contracting began in October and continued until manufacturers had orders on their books for several months.

**RANGE OF IRON AND STEEL PRICES IN PITTSBURG, 1901.**

	Jan.	Feb.	Mar.	April.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Bess. pig iron..	\$13.25	\$14.75	\$17.00	\$17.00	\$16.25	\$16.00	\$16.00	\$16.00	\$16.00	\$16.25	\$16.75	\$16.75
Basic pig iron.	12.25	13.75	16.00	16.00	15.35	15.00	15.00	15.00	15.00	15.75	15.75	15.75
F'ndry No. 2..	14.25	14.50	15.25	15.25	14.75	14.50	14.50	14.25	14.25	14.75	15.50	16.25
Gray forge...	13.25	13.75	14.50	14.50	14.25	14.00	14.00	13.75	13.75	14.00	14.75	15.00
Bess. steel bil.	19.75	21.00	24.00	24.00	24.00	24.00	24.00	24.50	26.50	27.50	28.00	28.00
Sheets No. 27.	2.90	2.90	3.20	3.20	3.20	3.20	3.50	3.70	3.40	3.30	3.10	3.10
Sheets No. 28.	3.00	3.00	3.30	3.30	3.30	3.30	3.60	3.80	3.50	3.40	3.20	3.20
Tank plates...	1.40	1.40	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
Steel bars...	1.25	1.35	1.50	1.50	1.45	1.45	1.45	1.55	1.50	1.50	1.50	1.50
Steel rails...	26.00	26.00	26.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
Wire nails...	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.25	2.05	2.05
Cut nails...	2.05	2.05	2.00	2.00	2.00	2.00	2.00	2.05	2.05	2.05	2.05	2.05
Ferromang...	62.50	62.50	62.50	58.50	58.50	58.50	53.50	53.50	53.50	53.50	53.50	52.50

One of the most important events of the year was the formation of the largest combination ever known, the United States Steel Corporation, which was perfected in April. It took over some of the most important plants in the Pittsburgh District, including the large interests of the Carnegie Company, and plants of the American Tin Plate Company, the American Steel Sheet Company, the American Steel Hoop Company, the American Steel and Wire Company, the American Bridge Company and the National Tube Company. Other concerns compose the big combine that do not operate in this district. One of the results of the consolidation was the establishing of firmer prices and an advancing of rates on many lines. Wire and wire nails, however, remained practically unchanged throughout the year. Soon after the corporation began doing business the Amalgamated Association made an attempt to secure recognition by ordering a strike at the McKeesport plant of the American Sheet Steel Company, the cause being the discharge of several men who had joined the organization. A threat to extend the strike to all union plants operated under the Amalgamated scale and rules had the desired effect, as the corporation was young and could not afford to engage in a struggle. The discharged men were reinstated and further trouble was averted.

The Amalgamated scale expired on June 30, and a new agreement was entered into with the independent companies that operate union mills, and the Republic Iron and Steel Company. An effort was made to open negotiations with the United States Steel Corporation with a view to introduce the association's scale of wages at all of the big corporation's plants. The announcement was made that the wage scales would be considered by the constituent companies as in former years. A settlement was speedily

reached with the American Tin Plate Company, as all of its plants, with one exception, were on the union list. Unusually favorable terms were conceded as the tin plate combine had orders on its books for several months ahead, and for the first time was forced to operate its works in July. The American Sheet Steel Company and the American Steel Hoop Company were willing to grant the demands made, but refused to sign the scale for works that had been operated as non-union, and where the Amalgamated Association had no organization. All the union plants of these companies were closed on July 1, pending a settlement of the question. Several fruitless conferences were held, until Saturday, July 13, when a strike order was issued. Despite the fact that all the plants of the American Tin Plate Company were in full operation under a scale of wages satisfactory to the workmen, they were included in the order to strike, and every union plant suspended operations. A bitter fight began, which proved to be one of the greatest struggles between capital and labor in many years. The United States Steel Corporation soon began to open its plants, and succeeded in getting some of them started with non-union workmen. After the strike had been on for four weeks, with no indications of any concessions being made by the steel corporation, the Amalgamated Association issued an order for a general strike. This called out the union men employed at the works of the Federal Steel Company, the National Steel Company and the National Tube Company. The order was issued on Saturday, August 10. Most of the men responded, but the Chicago works of the Federal Steel Company continued in operation. The strike was settled at a conference between officials of the United States Steel Corporation and the Amalgamated

Association, held in New York on Saturday, September 13. The terms of settlement were less favorable than had been rejected by the workers, just two months previous to the settlement. The Amalgamated Association lost heavily by the strike. Reports of the United States Steel Corporation showed that the earnings for the month of August were greater than any previous month. There is no doubt, however, that the profits would have been larger, but for the strike. The suspension of the steel, hoop, sheets, tube and tin plate mills did not affect the prices of pig iron or finished material, except sheets. At the opening of the strike the American Sheet Steel Company announced a reduction of \$4 a ton. Its production was curtailed and all deliveries made were on orders taken at the former prices. The independent sheet concerns operated their plants to the fullest capacity, all sales made during the strike being at \$18 a ton above the price fixed by the sheet combination for No. 28 gauge for prompt shipment. The price ranged from 3.60 to 4 cents during July, August and September. At the end of the strike the combination continued to quote 3.10c. for No. 28 gauge.

While the year 1900 closed with the markets in an unsatisfactory condition, the first two weeks of the new year showed a decided improvement with prospects better than manufacturers had anticipated. Prices of pig iron were a trifle firmer, and some large sales were made, the heaviest being the purchase of 150,000 tons of bessemer pig iron in January by the Carnegie Steel Company. Other concerns placed orders aggregating about half that amount. Buying continued and at the close of the second month the price of bessemer iron had advanced from \$13.25, the price at the opening of the year, to \$14.75, Pittsburg.

The following two months sales were made at \$17, when there was a drop, and during the rest of the year the price ranged from \$16 to \$16.75, although in the last quarter a higher price was paid for prompt delivery.

### THE CLEVELAND IRON MARKET IN 1901.

By Our Special Correspondent.

*Pig Iron*—As the shipment of iron ore indicates, the production of pig iron in this section has been unprecedented. Hereafter it may be said that for one year at least, in the history of America's iron trade, there has hardly been a time when the demand was not in excess of the production. It is true that the year opened with the furnaces not yet recovered from the effects of the presidential campaign, although it is now frankly admitted that the excessive prices of the fall of 1900 had more to do with the lack of demand, than the uncertainty as to the result of the national campaign, which was simply a good scapegoat.

The policy is based upon a new theory, that has come to rule among the great producers of the country, which is that there is no such thing as overproduction when the price of the material is within the reach of those who need it. The prices, at which the grades of steel are being produced, are computed to the point where it is possible, at them, to give all concerned in the production of steel a chance to make a reasonable profit, and yet keep the material at that selling point where it is also a reasonable price for the consumer to pay. To do this it has demanded a very strong hand, admittedly—for during the most of the time the market has shown runaway tendencies, buyers offering premiums frequently if the steel could be obtained. In the light of this policy in the manufacture and sale of finished steel the attitude of the Steel Corporation felt toward the shippers and vessel owners on the lakes can better be understood since to maintain a stable price for the finished material there must also be a fixed price for the different ingredients. At the close of this remarkable year, therefore, it seems evident that the lasting prosperity of the country has just started, for there are orders on the books now which assure another year of the great possible activity in steel production, and at this time there is not even the slightest indication of a break in the market.

At any rate the year opened with prices ranging about 50 per cent of that which they attained at the climax of the preceding year and quotations of \$13.50 on Bessemer in the valleys was not an uncommon thing. The prices increased by easy gradations during the first two months of the year until the boom in finished material started, and by the time the United States Steel Corporation was formed, or the later part of April and the first of May, they were ready to settle upon a permanent basis which should last through the year. The first buying of pig iron of consequence came about the first of March, and before much more than a fortnight had passed all of the material available before July had been entirely sold up. With these sales the furnaces which had been idle for 3 or 4 months, opened, and did not have occasion to shut down again until the middle of October, when a scarcity of cars for the coke trade cut short the supply of that material, and the furnaces went out of blast temporarily, for the want of it. The spring rush had established prices at approximately \$15.25 for bessemer; \$14.25 for basic and \$13.50@14 respectively for No. 1 and No. 2 foundry. These prices held without intermission until the fall of the year, when the immense consumption of steel and the inability to produce iron fast enough destroyed the ratio between the iron produced and that needed, and the furnace men were forced to put the price up. At the end of the year bessemer was bringing \$15.75 in the Valley; basic \$15.25 also in the Valley and the foundry grades were selling at \$16 for No. 1 and \$15.50 for No. 2 in the Valleys, with some iron being brought from the Birmingham District to help out. There was but

one time during the year—and that was of short duration—when the demand for pig iron even slackened, which was during the strike of the Amalgamated Association.

*Finished Material*.—If the effects of the organization of the United States Steel Corporation have been revolutionary as to the ore trade, they have been more striking in the finished steel trade. In fact, however, the market conditions were leading up gradually and by easy gradations to the consummation reached in the latter part of April. The fact that the prices of steel plate and structural material had been held arbitrarily at 2.25 cents during the previous year had brought about such a revulsion among the buyers that the market broke and did not begin to recover until the first of the year, at which time some of the mill men had begun to realize that operation for large and immediate profit was a wrong basis, and they began to mend affairs. The first few months of 1901, as well as December of the preceding year, saw therefore a steady movement toward the formation of pools and the controlling of all prices and conditions at which steel should be disposed of and under which it should be produced. When business showed signs of an awakening in the spring about every grade of steel was governed by a pool. There had been a long fight between the railroads and the steel mills as to the price of rails. The pool was formed and established \$26 as the arbitrary price demanded, and it was paid on millions of tons that were sold early in March and April. The plate pool had decided upon 1.50 cents, Cleveland, and within a quarter had advanced to 1.60 cents and then—under the United States Steel Corporation—to 1.70 cents in Cleveland. This price, however, was not worked out until a vast amount of the material available for the year had been sold at a less figure. This having been recognized as a reasonable rate, the United States Steel Corporation, which had taken possession of the steel trade by June 1, brought structural material and plates upon the same basis and was working the other grades around to the same point. Bars were harder to govern due to the diversified sources of production and it was not until late in the fall that anything like a permanent agreement was reached as to the price of bars. There was a dispute as to the basing points for the prices, as between Pittsburg and Youngstown and when the former was settled upon, it was upon a basis which announced an advance in the price of iron bars as against bessemer steel bars, working a hardship therefore upon the iron bar producers. The price is now settled, however, at 1.50 cents, Pittsburg, for bessemer steel bars and iron bars and 1.60 cents, Pittsburg, for open-hearth steel bars, and this seems to be an equitable basis, for the complaints of unequal conditions in the market have disappeared. As to rails, the pool price of \$26 did not last long after the United States Steel Corporation came into existence, for the price was advanced to \$28 and held there during the entire year and has even been made applicable upon the sales of rails which, already at this date, have about taken up the entire output for the season of 1902. During the year the producers of bars and sheets were subject to a delay of six weeks on account of the ill-timed strike of the Amalgamated Association of Iron and Steel Workers. At the time the strike was declared the pace at which production was going ahead was such a maddening one that some were apprehensive lest the output should exceed the demand and bring about another period of overproduction which would have disastrous results. It was, therefore, with something of a sigh of relief that the mill men hailed the announcement of the beginning of a strike. Before it was over they realized that there was some mistake about their estimation of the market, for some buyers were actually importing large quantities of sheets, and among them one large electrical company in Cleveland. Nothing but the installing of a new bar mill would ever have brought the bar producers out of the tangle into which they fell. Whereas it had been expected that the bar market would be uncommonly strong for months, the addition of the Carnegie-Duquesne mill, with a weekly output of 400 tons.

has done very much to relieve the situation and the mills have long ago caught up on what they were short.

From the standpoint of production and demand the year had two remarkable periods, one of them the middle of March, the other the beginning of October and November. In March the possible output for the following six or nine months was sold up. Beginning with October some remarkable sales of steel were made, which not only tied up, in contracts, the possible output for six or nine months, but went to the extent, in some grades, of 12 to 15 months, which can probably be traced back to another remarkable policy introduced by the United States Steel Corporation. The very fact that steel is sold so far ahead gives evidence of an immense demand for it. Under the circumstances that prevailed two years before, the steel producers would have taken every advantage possible of the present market by getting as much money for the steel as possible. The Steel Corporation, however, introduced the idea of stability of prices in boom times as well as in slack. It carried out this idea to a remarkable extent and has probably been the cause for greater sales than any one thing that was ever done in the steel business. It is a fact that, since the Steel Corporation took hold of the market the first of June, it has been virtually combating the prices, which the market gave evidence of producing or rather of making possible. The belief among the prospective buyers in the Corporation's adherence to these prices has occasioned the buying, which started late in the year and has already about covered the steel rail output for a year, the billet supply for nine months and the structural material output for six or seven months.

### THE IRON INDUSTRY OF ALABAMA IN 1901

By Our Special Correspondent.

A retrospect of the year shows that shipments of pig iron from Alabama were practically the production, while in 1900, there was considerable iron shipped which had accumulated on the yards from the year before. The total shipments for the year, however, from Alabama and Tennessee, show a marked increase, and conditions to-day are in a better shape than they were at the beginning of 1901. For the first quarter of the year prospects were doubtful.

To-day the pig iron market in the South is firm and strong, fairly good quotations in vogue and orders on hand for several months ahead and a good line of inquiries being made. Preparations are being made to increase the production at an early date and the furnace men and other interests are confident as to the future.

Some trouble was caused by shortage of railroad equipment for the transportation of iron and manufacturers could not move their orders with promptness. During 1901, one new furnace was built, four or five repaired—two of them practically rebuilt—three new foundries built, two foundries and machine shops rebuilt and enlarged, a steel rail mill built, one old rolling mill rebuilt and tube works constructed, a hollow ware plant erected, a stove factory enlarged and much other work done in Alabama and in the Birmingham District. The steel plant at Ensley was repaired during the year and departments in the steel wire, rod and nail works enlarged. All of the establishments using steel and iron in their daily operation had steady work through the entire year and much work was done not only for Alabama but for many other States and for Mexico, Cuba, South and Central America. The foreign countries received sugar making machinery from this district, while gasoline engines manufactured here were shipped during the past year as far as Johannesburg, South Africa. Other shipments, such as plow shares and steel wire were sent to Mexico and Central America from this district. There was not as much pig iron shipped to the English markets as last year by over 200,000 tons, but the domestic market made up the difference.



The figures secured from the Southern Iron Committee as to shipments of pig iron, steel and cast iron pipe from Alabama and Tennessee, tell the story best of the year's doing. The following tables are made up from these figures:

**Pig Iron.**—January, 116,396 tons; February, 114,261; March, 145,254; April, 138,427; May, 129,230; June, 106,569; July, 111,754; August 123,513; September, 123,522; October, 145,670; November, 150,136; December, (estimated), 145,000; total, 1,549,732 tons. The pig iron shipments from Alabama and Tennessee during 1900, amounted to 1,327,741 tons, showing a good increase for the year 1901.

**Cast Iron Pipe.**—January, 10,837 tons; February, 10,490; March, 13,172; April, 14,953; May, 15,263; June, 15,195; July, 15,959; August, 14,550; September, 13,703; October, 15,269; November, 10,952; December, (estimated), 8,000; total, 158,343 tons. The shipments during 1900 amounted to 88,950 tons.

**Export Pig Iron.**—January, 9,181 tons; February, 4,823; March, 2,920; April, 1,725; May, 156; June, 494; July, 152; August, 131; September, 902; October, 752; November, 463; December, (estimated), 350; total, 22,049 tons. The export pig iron shipments from Alabama and Tennessee during 1900 amounted to 238,615 tons. There was not much attention paid to the export trade during 1901 as is to be observed in the figures given.

**Cast Iron Pipe Exports.**—January, 241 tons; February, 240; March, 434; April, 574; May, 165; June, 129; July, 122; August, 134; September, 168; October, 122; November, 271; December, (estimated), 150; total, 2,750. The total export shipments of cast iron pipe during 1900 amounted to 9,700 tons.

From the Birmingham District alone the shipments, included above, were as follows:

**Pig Iron.**—January, 65,669 tons; February, 65,206; March, 81,018; April, 78,435; May, 74,013; June, 56,966; July, 57,245; August, 56,987; September, 58,209; October, 68,376; November, 67,927; December, (estimated), 66,000; total, 796,054 tons. The total pig iron shipments from Birmingham during 1900 amounted to 817,972 tons. The shipments this year are practically the production.

**Cast Iron Pipe.**—Estimating shipments for December, the total reached 78,640 tons. The cast iron pipe shipments during the year 1900 amounted to 29,114 tons.

**Export Pig Iron.**—Shipments from the Birmingham District during the year, estimating December, will be 20,496 tons. The export cast iron pipe shipments for the year amount to 1,551 tons.

The future appears very bright for the Birmingham District, in fact for the entire Southern field. There are four furnaces almost ready, which will be blown in within the next 90 days. The new furnace of the Republic Iron and Steel Company at Thomas, will be blown in now very shortly. It will have the largest capacity of any in the South and its construction means well for the district. The Tennessee Coal, Iron and Railroad Company has two furnaces under repair now; the North Alabama Coal and Iron Company, one; the Woodstock Iron Company will shortly place a force of men at work repairing two furnaces; the Sloss-Sheffield Steel and Iron Company has one furnace undergoing repairs.

There are 41 furnaces in Alabama, and 30 in operation. Of the 11 furnaces remaining it is believed that before long 6 will be in operation. There are no doubts about the supply of raw material. The production in this line is quite satisfactory.

The steel industry is on the increase. During the present year shipments of steel are given as follows: January, 4,261 tons; February, 3,640; March, 5,437; April, 2,869; May, 6,735; June, 5,939; July, 4,695; August, 5,256; September, 3,583; October, 5,539; November, 7,769; December, (estimated), 4,277; total, 60,000 tons. For the com-

ing year there are very bright prospects. Additional improvements will be made at the Ensley steel plant. During the coming year it is believed the Republic Iron and Steel Company will start work on a large steel plant in the Birmingham District. The steel rail mill of the Tennessee Coal, Iron and Railroad Company, of which so much has been said in the past, will be ready for operation about March, and a number of orders are already on hand for rails.

The foundries and machine shops in Alabama also have good prospects for the coming year.

**THE PHILADELPHIA IRON MARKET IN 1901.**

BY OUR SPECIAL CORRESPONDENT.

The year 1901 was eventful from every point of view, excepting that of fluctuation in prices. The territory of which Philadelphia is the commercial center in iron and steel has been subject to fewer fluctuations, less disturbance and less uncertainty than perhaps any region in the United States. It is, more than any other location, self-supporting and has less to do with outside supplies. A large percentage of the material entering into furnace and mill products is derived from within its boundaries and the larger part of its product is sold within its borders. Being the oldest iron producing region, it has a larger percentage of old style mills, and in that respect is at a disadvantage with competing localities. During the last year it has suffered less from invasion from the outside and has sold a larger percentage of its products into outside territory than in previous years. Less money has been expended in improvements and expansions for the capital invested than in other sections. No territory is so much closed in and hampered as Eastern Pennsylvania. It lacks in certain competitive transportation advantages possessed by other localities. It is at a disadvantage in the richness of more or less of the ore used. It pays a higher ton-mile rate for transporting raw and finished materials than some other sections. All in all, the Eastern Pennsylvania pig iron manufacturer and the maker of finished products are at a disadvantage with respect to competitors. Despite all these drawbacks, a study of statistics shows a steady expansion of the industry.

It is among these diverse influences that are to be found the reasons why the spirit of combination has flourished so indifferently and why mammoth plants are few. The great stimulus which has been imparted to iron and steel production elsewhere has not been felt here so keenly. The few large plants have found their best policy to be in a certain diversity of product, even two or three of the great rail mills discovering that this diversity was essential to success.

One feature deserving incidental mention is that for 30 or 40 years labor agitations have been exceptional. The greatest labor disturbance on record was a very negative one and occurred 51 years ago when a large number of eastern puddlers were gathered together and shipped to Pittsburg to take the places of the striking puddlers in the famous, but long forgotten, strike of 1850. It is not generally known that it was that strike and its disastrous consequences which led to the organization of the United Sons of Vulcan, which a generation ago became the Amalgamated Association of Iron and Steel Workers.

As to the course of trade since January 1, 1901, in Eastern Pennsylvania, the story is easily told. Prices of the following products averaged: No. 1X foundry, \$16 to \$16.50; 2X foundry, \$16; gray forge, \$14.50 to \$14.75; bessemer pig, \$16 to \$16.50. Foundry and forge iron kept on a pretty even trend, and only at recent dates have upward fluctuations attracted serious attention.

Basic and bessemer pig responded to the active demand, while billets advanced 25 per cent, nominally at least. The real selling prices for most of the forward deliveries have not, however, cost so much more. The controlling influences in foundry, forge, basic and bessemer iron and steel billets, it is believed, see it to their ultimate interests to not take

short advantage of market conditions to run up prices. This is notably evident in steel rails, the demand for which has covered more of the incoming year's requirements than has been recorded at the same date in any previous year. It is generally accepted in iron trade circles in Eastern Pennsylvania that trolley road requirements for the coming year will be much larger than this or last year and that during the coming winter measures will be taken to increase girder rail capacity.

In other branches of finished material Eastern Pennsylvania capacity is well oversold. Centralization in structural mill capacity has harmonized eastern interests. The attempted plate combination was cordially entered upon, but diverse conditions and high valuations have obstructed a harmonious adjustment thus far. Bar-mill capacity throughout Eastern Pennsylvania is not far removed from the point of overtaking demand. Sheet-mill capacity is farther oversold; so is tube capacity, but the pipe mills are fast catching up. The cast pipe interests in this region have pursued a very conservative course and have not increased capacity to a dangerous degree. The passing of two or three large plants under the control of the Pennsylvania Railroad Company has served to give confidence to continued steadiness of prices in the specialties of the mills concerned. Certain other large corporations like the Tidewater, the Diamond State and one or two others have strengthened their position against the day of depression by turning their attention to various specialties.

A fair and unbiased conclusion is that Eastern Pennsylvania iron and steel interests are not holding their own as vigorously as before the day of great combinations. The conditions east are not favorable to consolidation, mills being scattered and working under certain disadvantages and possessing a limited trade, and besides having a narrower margin of profits.

The following table shows the lowest, the highest and the closing prices of the principal articles:

Pig Iron:	Lowest.	Highest.	Closing.
No. 1X foundry.....	\$16.00	\$16.50	\$16.50
No. 2X foundry.....	15.00	16.00	16.00
Gray forge.....	14.00	14.75	14.75
Bessemer.....	15.00	16.50	16.50
Basic.....	14.00	15.00	15.00
Steel billets, spot.....	22.00	29.00	29.00
Steel billets, futures.....	24.00	27.00	27.00
Iron bars.....	1.40	1.75	1.72½
Steel bars.....	1.40	1.77½	1.77½
Plates:			
Quarter-inch.....	1.55	1.75	1.75
Universals.....	1.55	1.75	1.75
Flange.....	1.75	2.00	2.00
Sheets.....	2.20@3.40	2.55@4.65	2.10@4.40
Structural shapes.....	1.70	1.75	1.85
Beams.....	1.70	1.75	1.85
Old iron rails.....	18.00	21.50	21.50
Steel rails.....	15.00	18.00	18.00

It will be seen that in almost every case the closing prices were also the highest prices of the year.

**THE CHICAGO COAL AND IRON MARKETS.**

BY OUR SPECIAL CORRESPONDENT.

Iron and coal men in Chicago have put the year 1901 down as a record breaker. This district has shared the general prosperity of the country, and the manufacturers of everything into which iron enters, are full of orders, some of them having sufficient business on hand and in sight to justify the prediction that their plants will be kept running to the limit of capacity for two years more at least. The molders' and machinists' strikes did not materially change the year's output of manufactured product. The coal mines of Indiana and Illinois have not been embarrassed by labor troubles excepting in some minor instances. It is curious, however, that the mine owners are not satisfied with the year's business; they have kept their mines running and have shipped more coal than before, but they claim that the prices they have received for their output were too low, considering the general advance of prices on other products. The jobbing coal interests, however, have had an exceedingly profitable year. The fall demand for coal in this city alone passed all previous records, and the summer business was much larger than the most sanguine had hoped for in the Spring.

The year, however, closed with an alarming condition confronting manufacturers in this district. The utter inability of the railroad companies to handle the immense volumes of traffic offered, is looked upon with considerable apprehension by manufacturers who use iron, coal and coke. This so-called car famine, which is not a car famine, but a lack of motive power and track equipment, is threatening this district with a coke famine which has been due for the last 60 days and which apparently is in sight. In spite of the fact that the demands of trade call for more foundry pig iron, eight of the local blast furnaces recently shut down because of the lack of coke.

As yet the roads leading west of Chicago have been able to fairly meet the traffic demands. The "case of railroad rattles" as this car famine is called in Chicago, is virulent only between Chicago and the East.

Pig iron dealers estimate that the consumption of pig iron in the Chicago District—which takes in the territory within 200 miles radius—for 1901, approximated 750,000 tons outside of the pig iron used by the Illinois Steel Company. It was given out by the Illinois Steel Company, that the mills of that corporation consumed in 1901 about 1,500,000 tons of pig iron, and about 2,250,000 tons iron ore. The pig iron consumption in the Chicago District was 10 per cent greater than in previous years. Prices have been steady, and the Chicago dealers have pushed their trade even into Canada. At no time has there been a greater variation in price than one dollar a ton. The pig iron situation in Chicago is satisfactory excepting as it is clouded by the present car famine. The outlook is highly encouraging, but there are some dealers and manufacturers who are inclined to be somewhat pessimistic, and they say that before next summer there will be a slump in prices.

The anthracite coal business has been satisfactory to the dealers in this district, for prices were of course well maintained and the demand for the coal has steadily increased from the first of the year. There was received by lake and rail up to December 1, (11 months) 2,003,825 tons of anthracite; about 167,000 tons were received in December, making a total approximating 2,170,000 tons for the year. There were about 525,000 tons of Pittsburg and Youghiogheny coal received in Chicago in 1901; something over 475,000 tons of Ohio coal; and nearly 1,000,000 of West Virginia and Kentucky coal.

The coal-fields of Illinois up to November 31 sent 2,303,088 tons of bituminous coal to Chicago, and the estimated December receipts make the year total nearly 2,400,000 tons. The Indiana coal-fields sent about 2,100,000 tons to this point. The receipts of coke from the East up to December 1, amounted to 543,960 tons, about 15,000 tons less than were received for the corresponding time in 1900. This falling off, of course, was due to the car famine. From January 1 to December 1, 1901, nearly 500,000 tons of anthracite coal were shipped out of Chicago. This was an increase of 250,000 tons over 1900. For the same period the shipments of bituminous coal out of Chicago amounted to about 1,100,000 tons, or about 125,000 tons less than for the like period of the preceding year. This indicated that the local consumption was larger than in 1900. The outward shipment of coke up to December 1 amounted to about 365,000 tons, a slight increase over the same period in 1900.

**THE BELGIAN IRON TRADE.**—Exports of iron and steel from Belgium for the 10 months ending October 31, included 165,363 tons of bars and shapes; 54,830 tons of plates; 18,159 tons of beams and girders; 100,586 tons of rails; a total of 338,938 metric tons. This is a decrease of 4,838 tons, or 0.1 per cent, as compared with 1900. There was a small increase in bars this year, and a large one in rails, all the other times showing decreases.

### THE LAKE IRON ORE TRADE IN 1901.

BY OUR SPECIAL CORRESPONDENT.

The season of navigation of the year 1901 will stand for many decades to come as one of the most remarkable in history, especially as it pertains to the movement, by the lake routes, of the iron ore output of the northwestern mines. The points which stand out in marked contrast with other years are that the shipment of ore, for the first time in history, exceeded 20,000,000 of tons, to which point both shippers and vessel owners have been exerting their best efforts for five years; and that also for the first time in history the laws of supply and demand, as they pertain to the rates of carriage of iron ore, have been set at defiance and an arbitrary rate has ruled. Both of these results may in a large measure be attributed to the formation of the United States Steel Corporation and the policy it pursued. What a task this organization set for itself can best be understood in the light of conditions with which the officers of the ore handling arm of the Steel Corporation were confronted. During the preceding year an effort to control the lake rates had been made by the Bessemer Steamship Company, with the result that Mr. Rockefeller's boats met with a signal defeat and vessels with a computed carrying capacity of 2,000,000 tons went to the docks. This gave the ore shippers excellent ground for the assertion that the lake fleet was that amount of tonnage in excess of the needs of the lake trade, the amount of all commodities to be shipped during the season of 1901 being equal to that of the season of 1900. During the winter of 1900-01 there was an unprecedented production of vessel tonnage, 40 big ships in all having been turned out of the local yards. Added to this a number of lake craft which had been on the coast during the preceding year came back to the lakes convinced that the trade here afforded a better field of operation than the Atlantic. It was computed in the spring that, on the basis of the previous year's business, the lake fleet was easily 5,000,000 tons in excess of the possible needs of the trade. But it is customary to compute a yearly increase of 1,000,000 tons in the ore trade and 1,000,000 tons in the coal trade; consequently upon this basis the lake fleet would still be 3,000,000 tons carrying capacity in excess of the demands upon it. These computations necessarily depended upon the boats obtaining good dispatch at both the loading and the unloading docks. These possibilities led to some sharp wrangling between the shippers and the vessel owners throughout the spring and when the United States Steel Corporation was organized in April the question of season rates was still undecided. Under the name of the Pittsburg Steamship Company all of the fleets controlled by the steel and iron producing concerns, which became constituent to the Steel Corporation, were collected and given into the hands of A. B. Wolvin, of Duluth, to manage, with a branch office in Cleveland under the direction of Edwin S. Mills. This company virtually had to arrange for the shipment of the iron ore of the Steel Corporation as well as for the production of the ore. The fleet numbered 112 boats—steamers and barges—with an estimated carrying capacity—good dispatch being assured—of 9,000,000 tons. The Steel Corporation had in its own right mines which the year before had produced 10,000,000 tons of ore and also had a contract, which it had taken over with some of the steel concerns, for a supply of 2,000,000 tons of ore. With the moral advantage of such a fleet and with so much ore, for the carriage of which they had to arrange, the Pittsburg Steamship Company was able to step in between the independent shippers and the vessel owners and name a compromise rate of 80 cents as a basis for the movement from Duluth to Ohio ports. This rate was made to apply not only on season contracts, but also on the "wild" ore movement by the chartering of every vessel which presented itself between May 1 and October 1. On the latter date the Steel Corporation announced that all of its wild ore had been moved and what ore was yet to come might easily be handled by the boats of the Pitts-

burg fleet and those vessels which were under contract to the end of the season. The rates, all during the summer, upon the other leading articles of the lake commerce, did not equal the ore rate, as a natural consequence of which the ore trade took most of the wild boats. This resulted in the discomfiture of the other vessel owners, whose boats were operating under contract and the annoyance of those shippers of other materials who were unable to obtain the necessary boat capacity without paying rates out of keeping with the prices received for the materials. The immediate result of this action on the part of the Pittsburg Company was that the docks all along the south shore of Lake Erie were jammed with boats all summer and there was much complaint of a shortage of cars. When it is seen that the car supply was altogether adequate to the movement of over 1,500,000 tons of ore more than had ever been brought down the lakes, the delays at the docks can more readily be attributed to the policy of the over-chartering of wild boats than to the lack of railroad transportation facilities.

Whatever may have been the cause, the docks were constantly jammed and the delays in port were so extraordinary as to reduce the carrying capacity of the lake fleet by at least 20 per cent, or more than enough to take up the 3,000,000 tons carrying capacity that the lake fleet was supposed to have in excess of the possible needs of it. The statement that it more than took up the excess of tonnage is not based upon supposition, because all boats were constantly employed and yet many coal shippers were short, at the end of the year, on the amount of coal they had sold, and the grain shippers had all they could do to get their wheat down with the supply of corn cut down to the absolute minimum.

But these annoyances were more incidental to the cost than to the results aimed at in the shipment of ore—the supplying of the needs of the blast furnaces in the Valleys contiguous to the lake ports. Concerning this phase of the season's business nothing of a derogatory nature can be said. The results were admirable and remarkable beyond precedent. For instance, the reports, which have come in from the various receiving ports along Lake Erie, show that the following amounts were received between May 1 and the end of the season of navigation, December 10: Toledo, 798,298 tons; Sandusky, 33,017; Huron, 431,311; Lorain, 721,662; Cleveland, 3,831,060; Fairport, 1,181,776; Ashtabula, 3,981,170; Conneaut, 3,181,019; Erie, 1,379,377 tons; Buffalo and Tonawanda, 1,475,386. The total, all in gross tons, receipts for Lake Erie ports was, therefore, 17,014,076. The difference between this and the total output of the upper lake region of 20,157,522 gross tons, represents what ore was sent to the Steel Corporation docks at South Chicago. The computations, however, do not take cognizance of a certain movement of Canadian ore to United States ports which increases the total somewhat. For instance, it is known that the total output of the Michipicoten ore field, owned by Mr. Clergue as the head of new steel mills and pig iron producing plants at the Canadian Sault, was something like 230,000 tons. Of this amount 70,000 tons went to blast furnaces in Canadian territory and the remainder, 160,000 tons, came to south shore ports of Lake Erie, to be consumed by the furnaces in the Mahoning and Shenango valleys.

In this connection it might safely be predicted that shippers of iron ore will, in the future, have a new factor to take into consideration when making the basis of season ore prices. During the year 1900 only a single cargo of Canadian ore, 5,000 some odd tons, came to Ohio ports. This year a number of boats were regularly employed. Next season the producing machinery is to be increased, as is also the lake-carrying fleet. The Canadian production being almost a fixed quantity—until the new Clergue furnaces are completed—the increase in importation will be in direct proportion to the increase in production. This especially obtains since the Canadians have demonstrated that the difference in the cost of mining and of handling will allow them to compete



with the producers on the States' side, the 40-cent duty being made allowance for.

Another feature of the ore market during the year, which also goes far to disprove the theory of a shortage of cars, has been the remarkable direct movement from the docks to the furnace piles. It has been, in fact, upwards of 2,500,000 tons in excess of the previous year, which could not have occurred had the railroads been as derelict of duty as some have endeavored to show, in covering up the real issue. There were on the docks December 1, a total of 5,859,663 tons of ore, as against 5,904,670 tons at the same time a year ago. The shipment to the furnaces direct amounted to 14,204,596 tons, as against 11,613,773 for the preceding year. All told, therefore, the season of navigation as it pertains to the movement of iron ore was one of the most remarkable in the history of the chain of lakes or of the iron business.

The stocks of iron ore on docks at the Lake Erie ports on December 1 were as follows:

Ports.	1900.	1901.
Toledo.....	242,375	254,196
Sandusky.....	95,111	47,384
Huron.....	211,377	231,501
Lorain.....	251,838	195,863
Cleveland.....	1,337,445	1,378,060
Fairport.....	611,717	710,590
Ashtabula.....	1,811,459	1,769,145
Conneaut.....	630,514	604,106
Erie.....	480,734	470,718
Buffalo.....	232,100	198,100
Total.....	5,904,670	5,859,663

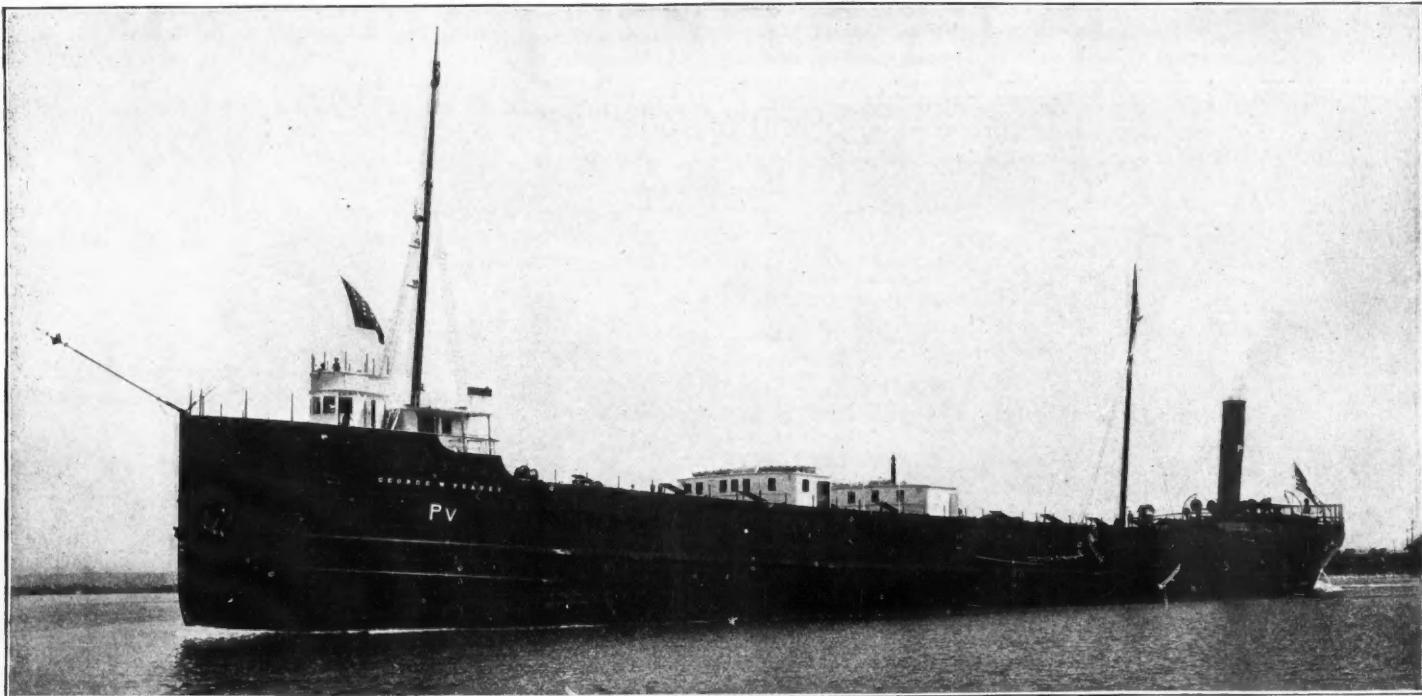
The stocks on docks at Lake Erie ports on May 1, 1901, amounted to 3,050,183 tons only. From present appearances these stocks will be lower yet when navigation opens for 1902.

LAKE SUPERIOR TRAFFIC IN 1901.

A notable illustration of the great business activ-

	1900.	1901.	Changes.
Anthracite coal.....	515,515	804,493	I. 288,978
Bituminous coal.....	3,971,462	3,788,643	D. 182,819
Total coal.....	4,486,977	4,593,136	I. 106,159
Iron ore.....	16,443,568	18,090,618	I. 1,647,050
Pig and manf'd iron...	135,585	206,443	I. 70,858
Copper.....	131,066	98,601	D. 32,465
Building stone.....	48,902	46,584	D. 2,318
Salt, barrels.....	328,895	443,774	I. 114,879

There were only three decreases in the list. That in copper was due to unusually heavy rail shipments made early in the year; while that in bituminous coal was the result entirely of the failure of the railroads to deliver coal at the Lake Erie ports in the latter part of the season. The small decrease in building stone calls for no special remark. Iron ore was 71.2 per cent of the east-bound freight, or 57.9 per cent of the total; while coal formed 86.4 per cent of the west-bound tonnage, and 16.2 per cent of the total.



LAKE ORE STEAMER "GEORGE W. PEAVEY."

The statement of shipments from the Lake Superior ports for the year ending December 1, as compiled by the Cleveland *Marine Review*, is as follows, in long tons, the rail shipments for 1901 being estimated:

	1900.	1901.
Escanaba.....	3,436,734	4,022,668
Marquette.....	2,661,861	2,354,284
Ashland.....	2,633,687	2,886,252
Two Harbors.....	4,007,294	5,018,197
Gladstone.....	418,854	117,089
Superior.....	1,522,899	2,321,077
Duluth.....	3,888,986	3,437,955
Total, by lake.....	18,570,315	20,157,522
Total, all rail.....	489,078	500,000
Total shipments.....	19,059,393	20,657,522

The total for 1899 was 18,251,804 tons; in 1898 it was 14,024,673 tons; in 1897 it was 12,469,638 tons, and in 1896 only 9,934,828 tons. The shipments have more than doubled in six years.

The receipts at Lake Erie ports for the year were as follows:

Ports.	1900.	1901.
Toledo.....	645,147	798,298
Sandusky.....	154,542	33,917
Huron.....	321,914	431,311
Lorain.....	1,090,235	721,662
Cleveland.....	3,376,644	3,831,060
Fairport.....	1,085,534	1,181,776
Ashtabula.....	3,709,486	3,981,170
Conneaut.....	2,556,631	3,181,019
Erie.....	1,240,715	1,379,377
Buffalo and Tonawanda.....	1,616,919	1,475,386
Total.....	15,797,787	17,014,076

The difference between these receipts and the shipments is in ore delivered at South Chicago and Milwaukee.

ity of the past year is found in the returns of Lake Superior traffic. The report for the full season of navigation shows that the vessels passing through the canals at Sault Ste. Marie, with the freight carried, were as follows:

	1900.	1901.	Changes.
Steamers.....	14,426	14,372	D. 54
Sail'g vessels and barges	4,004	4,482	I. 478
Small boats, etc.....	1,022	1,187	I. 165
Total passages.....	19,452	20,041	I. 589
Fr'ght carried, net tons	25,643,073	28,403,065	I. 2,759,992
Average cargo, tons...	1,318	1,417	I. 99

Of the total freight last year 25,582,038 tons, or 90.1 per cent, was carried by vessels passing through the United States canal, and 2,821,027 tons, or 9.9 per cent by those going through the Canadian canal. As to direction, 23,087,742 tons, or 81.3 per cent of the total, were east-bound, and 5,315,323 tons, or 18.7 per cent, west-bound freight. It may be added that in addition to the freight going through the locks, rafts containing 9,000,000 feet of pine logs and 10,000 cords of pulp-wood passed over the rapids.

The United States canal was opened on April 26, 1901, and closed December 11, showing a total season of 230 days. The Canadian canal had 246 clear days, opening April 20 and closing December 21. Taking the season at 230 days, the average number of lockages was 87 per day, which is pretty active work.

The mineral freights included in the total were as follows, in net tons, except salt, which is in barrels:

The Cleveland *Marine Review* makes an interesting comparison. In 1881 the total freight passing the Sault was 1,567,741 tons; in 1891 the total was 8,888,759 tons, and in 1901, it was 28,403,065 tons. The tonnage of last year was 3.2 times that of 10 years before, and 18.1 times that of 20 years ago.

NEW ORE-CARRYING VESSELS.

By WALDON FAWCETT.

The first year of the new century has witnessed some very important additions to the fleet of cargo-carrying vessels on the great lakes designed especially for the transportation of iron ore and from the number of freighters now building or under contract at the shipbuilding plants on the inland seas, it is very certain that the record for the year 1902 will equal, if not surpass, that of the past twelve months. Indeed, it is safe to predict that the first two years of the new cycle will stand out as one of the periods of greatest activity in the history of the lakes in the construction of craft destined to serve primarily as a most important link in the transportation chain connecting the ore mines of the Northwest and the blast furnaces at Chicago and in the Pittsburg district.

At the opening of the year 1901 there were under contract or construction in the lake ship yards a total of forty-eight freight-carrying vessels with an aggregate dead weight capacity of 187,050 gross tons. Ten of these vessels, however, were designed for service on the Atlantic so that the capacity of the vessels added to the fleet available for ore-carrying purposes

on the great lakes could not safely be placed at a figure much above 150,000 tons. This would indicate the provision of facilities for moving about 2,250,000 tons of freight in excess of the movement of 1900, but the fact that not nearly all of the new vessels were completed in time to engage in service during the full season of 1901 necessitates a considerable reduction of this estimate. There can be no doubt, however, that the provision of this extra vessel capacity was a factor in enabling the movement from upper to lower lake ports in 1901 of considerably more than a million tons of iron ore in excess of the amount moved during the season of navigation of 1900.

The building programme which was carried out on the Great Lakes during the past year offers some interesting and significant evidences of policy which have more or less direct bearing upon iron, steel and copper interests in general.\* For one thing the United States Steel Corporation, which controls a large portion of the ore producing properties in the Lake Superior district and also operates a fleet of over one hundred of the largest ore-carrying vessels on

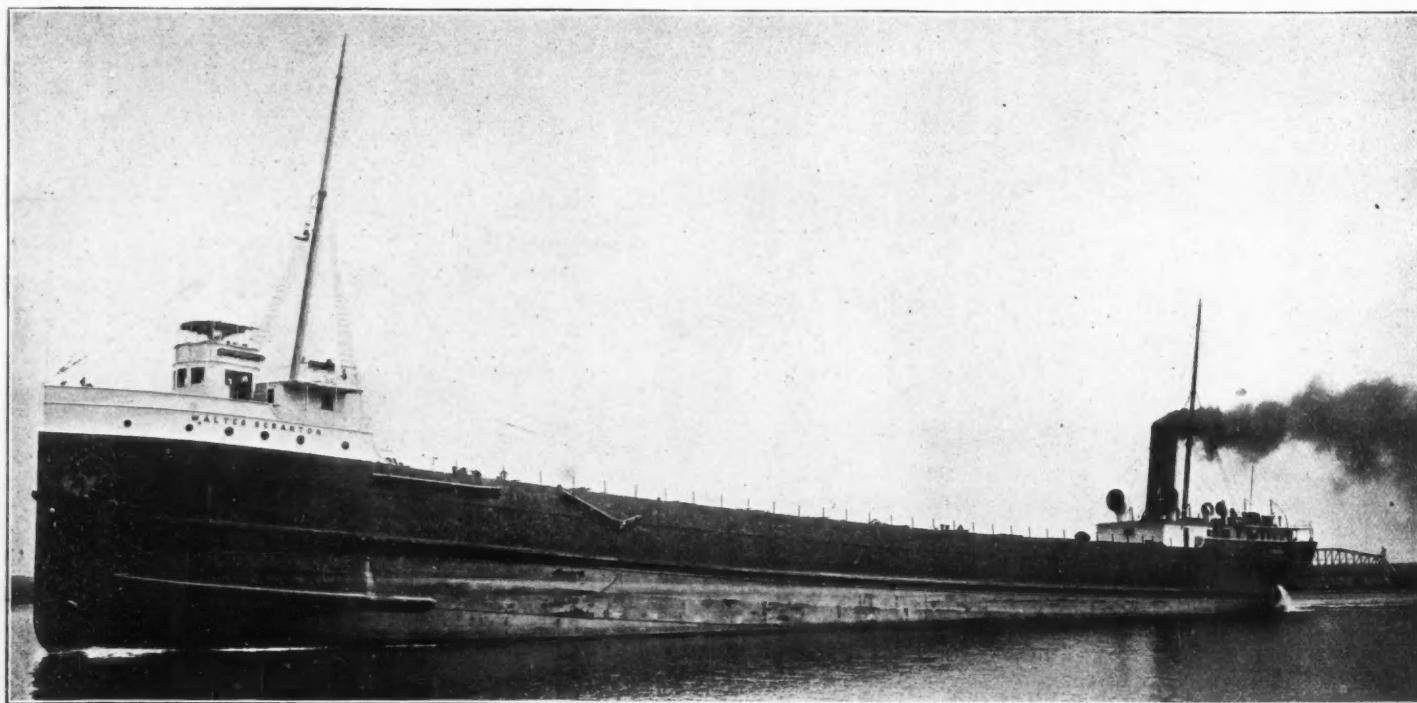
signed for the transportation of copper ore rather than for entrance into the iron ore trade. It is difficult to explain so universal a revulsion, although the action of the United States Steel Corporation in placing in control of its entire lake transportation interests a man who is known to be opposed to the towing plan may have had some indirect influence in the premises.

Among the most interesting additions recently made to the fresh water ore-carrying fleet is found a group of six vessels constructed by the American Ship Building Company at its yards at Lorain, Ohio and Detroit, Mich., for J. C. Gilchrist, of Cleveland. These vessels, the *Neptune*, *Saturn*, *Venus*, *Jupiter*, *Mars* and *Uranus*, are duplicates in every respect. The dimensions of each is 366 feet length over all, 346 feet length of keel, 48 feet beam and 28 feet depth. They are of steel construction throughout and fitted with triple expansion engines with cylinders 22, 35 and 58 inches diameter and 42 inches stroke, to which steam is supplied from Scotch boilers working at a pressure of 170 pounds. Each vessel cost approximately \$215,000 and is capable of

cost was \$275,000 each, in the case of some of the vessels, and \$280,000 each for the others, the fluctuation being due to a difference in the character of the boilers installed. Four of these vessels were built for F. H. Peavey, of Duluth, Minn., and the other two for C. W. Elphicke, of Chicago.

Four vessels have been built to the order of D. R. Hanna, of Cleveland, and his associates. Two of the vessels, the *G. A. Flagg* and *R. T. Warner*, are steamers, and the other two, the *S. D. Warriner* and *A. W. Thompson*, are schooners or barges, as they might more correctly be denominated. The steamers are each 336 feet in length, while the barges are each 312 feet in length. All four vessels have a uniform carrying capacity of 4,000 tons. The cost of the steamers was approximately \$180,000 each and of the barges \$120,000 each.

Any person at all conversant with the conditions previously prevailing in the ore-carrying trade will at once note in the above enumeration of dimensions and carrying capacities the very manifest inclination toward a general reduction in the size of the vessels engaged in this trade and this constitutes one of the



LAKE ORE STEAMER "WALTER SCRANTON."

the lakes, entirely withdrew from the field of new construction. During the closing year of the century a large proportion of all the new tonnage on the stocks at lake ship yards was building to the order of the iron and steel corporations which went to make up the great combination, but during the twelve-month just closed not a single vessel was built to the order of this company.

With the return to prominence of the individual vessel owners, who a short time since were apparently being forced from the field, there became manifest in an increasing degree a tendency to adhere to the class idea in the construction of vessels—in other words, to build a number of vessels which are virtual duplicates of each other in every respect. This has been the policy of almost every interest which has during the past year entered upon the construction of vessels for ore-carrying purposes. Another significant move is the virtual abandonment of the towing plan in so far as the new fleets are concerned. Heretofore, it has been the accepted practice on the Great Lakes to have a steamer tow one or two barges, each carrying a quantity of ore equal and perhaps in excess of the cargo of the propeller and consequently in the list of new ore carrying vessels constructed each year the steamers and barges have been about equal in number. This dawning year of the new century has witnessed a marked change in this respect. Only two barges were to be found in the entire building programme and these are de-

carrying 4,800 tons of ore on a draft of 18 feet, which is as great a depth of water as may now safely be counted upon in the connecting channels of the Great Lakes.

Mr. Gilchrist, who is the heaviest owner of the new tonnage which has appeared during 1901, also had constructed at a cost of \$220,000 each, two steel steamers, each of 376 feet length and capable of moving a cargo of 5,000 tons of ore. John Mitchell, of Cleveland, who has been a prominent figure in iron ore transportation circles for many years, added to his fleet two steel steamers, the *J. J. Albright* and *Walter Scranton*. These boats are 436 feet in length, 50 feet beam and 28 feet depth. They are each capable of transporting 6,000 tons of ore and cost \$285,000 apiece. Hutchinson & Co., of Cleveland, had built a steamer identical in every respect to those of the *Neptune* class built for Mr. Gilchrist, and a Detroit syndicate headed by Frank E. Kirby placed orders for two freighters, which, while costing no more than an equal number of the Gilchrist boats, exceed that type of vessel in length by 10 feet, each affording carrying capacity 300 tons greater than the *Neptune* or her sister vessels.

The largest cargo carriers constructed on the Great Lakes during 1901 form another class of six craft. The dimensions are 450 feet in length over all, 430 feet keel, 50 feet beam and 28 1-2 feet depth. The carrying capacity is 6,400 tons and the approximate

most radical innovations in the new tendencies lately manifest in this industry. Up to a year or two ago it seemed as though the representative type of ore-carrying vessel on the lakes was to continue to grow in size much after the fashion of its prototype in the oceanic trade and there were actually placed in service several vessels each approximately 500 feet in length and supposedly capable under the most favorable conditions of carrying upward of 9,000 tons of iron ore each.

The revulsion of sentiment appears, however, to be as permanent as decisive. As has been noted, the largest vessels added to the lake fleet during the past year have a length of 450 feet, whereas a considerable number of the new freighters are under 400 feet. This year the inclination in favor of the moderate sized cargo carrier is even more pronounced. Of the vessels at present building or under contract for delivery during the season of navigation of 1902 only six exceed 400 feet in length and the types of carriers ranging in length from 366 to 400 feet in length are even more numerous, in proportion to the whole, than they were in the building programme for the past season.

Ore transportation constitutes the backbone of the traffic of the Great Lakes and that every confidence is felt in its continued extension and development is evinced by the orders already placed for cargo-carrying vessels to be delivered during the calendar year 1902. The commissions thus far entered upon



the books of the shipbuilding companies represent between \$9,000,000 and \$10,000,000 and a much smaller proportion of the vessels contracted for are designed for salt-water service. The vessels already under contract, and all of which it is hoped can be delivered by August, 1902, will have an aggregate carrying capacity of about 150,000 tons or very close to that of the freighters added to the fleet during the season of 1901, but inasmuch as this added capacity will be available earlier in the season than was the case in 1901 and furthermore since it is probable that still other contracts for new freighters for delivery in 1902 will yet be placed it is not too much to anticipate than the gain in "season capacity," so called, will be greater in 1902 than in 1901.

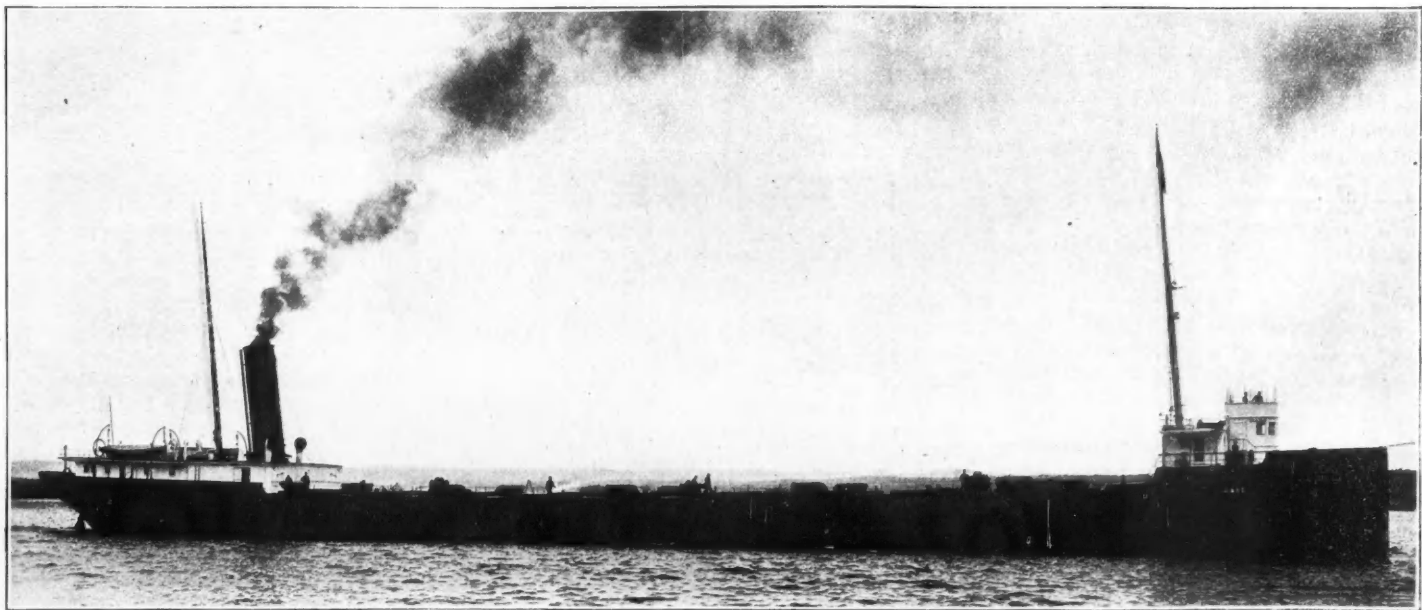
A comparison of the building programme for 1902 as thus far made up with that for the past season affords an interesting insight into the trend of influence in the inland ore transportation field. Mr. J. C. Gilchrist, of Cleveland, who figured as the largest individual investor in new tonnage during the season of 1901, again occupied that position for the ensuing year. He has, however, transferred his allegiance to

their fleet on each trip. Among the other commissions which go to make up the most extensive programme in the history of lake shipbuilding are a steamer and a barge for the Franklin Transportation Company, in which D. R. Hanna and M. A. Hanna, of Cleveland, are largely interested. These vessels are, it is understood, designed especially for the water transportation of ore and will supplement the craft constructed to the order of the same parties for that purpose during the past year. One of the new vessels will have a capacity of 4,800 tons, while the other will be capable of moving 5,350 tons of ore at a time.

A general glance at the programme for the construction of ore-carrying vessels to be carried out during the next few months conveys, as has been stated, a confirmation of the changes in policy outlined during 1901 and also adds to the list of outlined tendencies. For instance, the close of the season of 1901 has apparently witnessed the entire abandonment of all advocacy for placing quadruple expansion engines in freight-carrying vessels for use on the lakes, inasmuch as not one of the steamers to come out during

similar causes have made necessary a reduction in the output of ores. In the Anaconda it has been stated that forces were reduced in order to limit the output, but this must be accepted with some degree of reserve. The fact remains that, from a combination of all the causes referred to, operations in the Butte district were limited, and the number of unemployed miners in Butte was greater in December than had been the case for many months.

In the Arizona mines there was some falling off, although much less in amount than in Montana. The principal causes of this were a bad cave-in at the United Verde, which not only interrupted mining, but damaged the company's smelters. This and other accidents involved a great deal of reconstruction work in the lower levels, thus further restricting the output of ores. Of the other important Arizona mines, the group owned by the Copper Queen Consolidated Company, continued steadily at work and fully maintained its production; while the mines of the Arizona Copper Company at Clifton somewhat increased theirs, and are introducing new machinery. No important work was done by new mines in the Arizona District.



LAKE ORE STEAMER "MARS."

a somewhat larger type of carrier than he built heretofore. Mr. Gilchrist is now building a fleet of five steel steamers each 400 feet over all in length, 380 feet keel, 50 feet beam and 28 feet depth. The approximate cost of each is stated to be \$240,000 and each member of the new fleet represents a carrying capacity of 5,600 tons.

The interests represented by John Mitchell, of Cleveland, whose vessels have been regularly engaged in the iron ore traffic for many years past and some of whose vessels have at times been taken on season charters by prominent iron mining interests, also figures as a contractor for new tonnage for the coming season. He has contracted for four steel freighters—two to be delivered in May, 1902, and the remaining two in August of that year. These vessels are duplicates, in point of dimensions, of the steamer *H. C. Frick*, one of the best ore carriers on fresh water. Each is 436 feet in length, 50 feet beam, 28 feet keel and with a carrying capacity of 6,200 tons. The cost of these vessels when completed will be in the neighborhood of \$260,000 each.

The W. W. Brown Syndicate, of Cleveland, which is closely allied with iron ore mining interests, has under way six steel steamers ranging in length from 366 to 434 feet and in carrying capacity from 4,800 to 6,200 tons each. W. C. Richardson, of Cleveland, is building a steamer which will carry 4,900 tons; G. A. Tomlinson, of Duluth, Minn., has under way two vessels each of 4,800 tons capacity, and the Hawgood interests of Cleveland have under contract, or on the stocks, four steel steamers, which will add upward of 25,000 tons to the carrying capacity of

1902 will be fitted with anything but triple expansion engines. Evidently the water-tube boiler has also passed out of favor for this service, for all the new vessels will have steam generators of the Scotch type, although in about half the cases some form of forced or induced draft will be introduced.

#### COPPER IN 1901.

In the year 1900 the United States produced a total, including copper in copper sulphate, of 600,832,505 pounds of copper, of which the Montana mines furnished 254,460,713 pounds, those of Michigan 144,227,340, and the Arizona mines 115,403,846 pounds; the balance being drawn from mines in other States, and from ores worked chiefly for other metals.

In the year 1901 the production showed a moderate decrease for the first time in a number of years, and was not far from 595,000,000 pounds, including, as usual in our yearly statements, the copper in copper sulphate. The decrease of 5,800,000 pounds, was mainly in the latter part of the year, as there was comparatively little change up to the end of October. Of the three great copper-producing districts, that of Montana was the one in which the greater part of the falling off is reported. The condition of affairs in the Butte mines has been heretofore referred to in our columns. Litigation over the ownership of claims has interrupted operations in some important mines, while in others the necessity for extensive repairs to timbering and other underground work, the neglect of proper development work in advance of actual stoping of ore, and

The Lake Superior District showed an increase in production. The Calumet & Hecla maintained its usual production, while some other of the old mines, such as the Tamarack, the Osceola, the Quincy, the Atlantic and the Wolverine did well throughout the year. Of the new mines started in the boom of two years ago, a few such as the Baltic, the Copper Range and the Mohawk have reached the producing stage. Others are gradually approaching it, while in one instance—the Arcadian—a total failure is reported. Outside of these new mines, there has been a substantial addition to the machinery and milling capacity in use in the Lake District.

In the less important districts there has been an increase, though not a very large one, in production. The Mountain Copper Company in California added somewhat to its smelting capacity and is steadily at work. Some of the smaller mines in Shasta County, California, are also producing, although the Trinity Copper Company, which was floated in Boston early in the year has done little or nothing. In Utah the Highland Boy property of the Utah Consolidated Mines is becoming a producer of importance, and the Bingham Consolidated is also improving its condition. The promising copper properties in the St. George District in Southern Utah will show considerable development work during the current year. In the East, the Elizabeth Mine in Vermont has been at work, while in the same State the Ely is also being operated and arrangements are being made to extend work at the Union Mine in Corinth. In New Jersey, however, the Arlington Mine, of which a good deal was said a year ago, has not yet reached the producing stage, although a part of its reduction works

have been completed, and but little has been heard of the American Mine near Somerville. The reported discoveries—or rather rediscoveries—of copper on the trap range running from New Brunswick across to the Delaware, have amounted to little or nothing, the operations begun at Menlo Park and near Pennington, having failed to show copper in paying quantities.

There has been a considerable increase in the output of copper from ores worked chiefly for their values in the precious metals, notably in Colorado. All these increases, however, have been insufficient to offset the losses in Montana and Arizona.

Whether better results will be reached during the current year depends very largely upon the market conditions, which are fully discussed below.

**The World's Copper Production.**—For several years prior to 1898, the increase in the copper production of the world amounted to about 10 per cent in each year. In 1899 and again in 1900 the ratio of growth was much less, and in 1901 there was probably very little change from the total of 1900, which was 492,625 long tons. The figures of that year show that the United States is by far the most important of copper producers, since it furnished 272,536 tons, or about 55 per cent of the total output. Spain comes second in rank, although at a long distance, with a total of 53,718 tons. The other producers in that year which could lay claim to importance were Japan, with 28,285 tons, Chile with 26,111 tons, Australia 23,368 tons, Mexico 22,403 tons, and Germany 20,635 tons. The production in most of these countries was at least as great and in some of them larger in 1901 than in 1900. The great deposits of copper-bearing pyrites in Spain continue to be worked very steadily. The Rio Tinto, the Tharsis and other mines showed some gain during the first half of the year, which was undoubtedly maintained during the second. In Japan the great Ashio Mine is now showing the effects of improved machinery and methods, while the damage done to the Deshii Mine by flood in 1900 has been fully repaired. The Chilean mines increased their shipments. In South America also a good deal of development work is being done in Peru, while the project for completing the railroads in Cerro de Pasco and for draining the mines there by tunnel is taking shape. In Australia there was little change in the mining conditions during the year. In Europe the Mansfeld Mine in Germany, the only important producer outside of the Spanish mines, seems to have been worked up to its fullest capacity and with the result of an increased production of copper. In Mexico the opening of the Nasonari mines is making progress, while the Boleo continued its usual output of copper. It is evident that the largest increase in this metal to be expected in the immediate future will come from Mexico and some of the important deposits of copper ores in that country are now controlled by capital from the United States. In the mines of our northern neighbor conditions have not been as favorable and the opening of new copper mines in British Columbia has made but little progress, although a few companies, such as the British Columbia Copper Company and the Granby Consolidated, did well through the year.

The important changes in the copper market during 1901, which seriously affected production, are fully discussed below.

#### THE COPPER MARKET IN 1901.

The course of the copper market during the year 1901 has been followed with marked attention, not only by those directly or indirectly interested in the production and consumption of the red metal, but also by the public at large. Several years of prosperity, high prices and consequent large profits for the mine owners had caused a confiding public to invest largely—and in a good many cases, blindly—in this industry at a time when close observers considered it necessary to trim their sails and call a warning to the over-confident.

For the first time in years, the exigencies of the

stock market had to be taken into consideration in trying to form opinions on the probable course of copper, although in the end, it is the inviolable law of supply and demand which will govern the price of this as well as any other staple article.

Production during the year 1901 does not show much increase over that of 1900, which is partially due to the seemingly endless litigation in Montana and a voluntary reduction in the output of some sections. However, a number of mines, which were floated during the last two years, especially at the Lakes in New Mexico, Arizona, California and British Columbia, have entered the list as active producers. Unless a long period of depressed prices prevents them from carrying on operations with a profit—and several of them claim to be able to produce very cheaply—an increase in the production is to be looked for. The refining capacity of the different works producing electrolytic copper was fully and profitably taken up—in fact, sundry lots of bullion and matte found their way to Europe; but it is to be expected that with the improvements and enlargements now under way, American refiners will be able to take care not only of the raw material produced in the United States, but also of the surplus from other parts of the world.

Business in this country has been very satisfactory, and the industries consuming copper have had their full share of activity. Both the wire and brass mills have been very busy throughout the year, and while prices for the former product have at times been cut and ruled comparatively low, those for the latter have been well maintained, owing to the elimination of some sharp competition by the formation of the American Brass Company, which controls a large number of well equipped mills throughout the country.

The railroads, which have all been rather prosperous, have called for heavy quantities of the red metal for use in the construction of locomotives and cars, and large orders have been placed by shipbuilding firms for use in the construction of vessels for the government and the merchant marine.

Building has been active in the East as well as in the West, and a fair tonnage has also been consumed in the manufacture of steam engines and other machinery.

The main increase, however, is to be found in the consumption of copper for electrical and traction purposes. Not long ago the opinion was freely expressed that the use of copper for the transmission of electrical power had about reached its height and that the only calls would be for repairs of trolley lines, etc. Instead, we have witnessed a most marvellous extension of this industry. Not only has the telephone system been enlarged, trolley lines extended and new ones put in operation, but existing cable systems have been abolished entirely in favor of underground trolley, and satisfactory trials have been concluded for the substitution of electricity on elevated roads and railroads, and it is only a question of time when the introduction of electricity, replacing steam power, will revolutionize the railroad systems of the world. Tests have been made with a view to utilizing aluminum and steel as a substitute for copper, but the results so far have not been of an encouraging nature.

The consumption of sulphate of copper was satisfactory, and though the production is large, the stocks which were carried forward after rather a busy season, are not expected to last very long.

Exports during the year under review showed a marked decrease. In 1900 shipments to European ports amounted to two-thirds of the production; in 1901 to about one-third. The falling off in exports is due to the depressed condition of business in Europe, caused in England by the South-African war and on the Continent by over-speculation. Naturally, new enterprises in which copper is required were suspended, and the result was a lessened demand on the part of the manufacturers. Aside from this, the disparity between the foreign and domestic markets has led to a heavy increase in importations.

The decrease in business in Europe was intensified by the reluctance on the part of manufacturers on this side to lay in stocks under present conditions. While thus consumers are practically bare of supplies, there is no doubt that the leading producing interests have been forced to carry the available stocks, which at the end of the year are variously estimated at from 100,000,000 to 150,000,000 lbs.

The Amalgamated Copper Company, whose policy influences the market to a great extent, a few months ago raised its capital from \$80,000,000 to \$155,000,000, for the purpose of acquiring the outstanding capital stock of the Boston & Montana Mining Company and the Butte & Boston Company. It now controls about one-fifth of the world's production of copper. Negotiations were at one time under way with the object of having the principal producers join in a movement to restrict production. It is questionable if in the long run the disadvantages resulting from such a measure would not outweigh the advantages.

The year opened with lake copper selling at 16 3-4 to 17 cents; electrolytic copper at 16 1-4 to 16 3-8 cents; casting copper at 16 cents. Business was rather dull, but improved during February, and a large demand sprang up for quick shipment. While lake copper remained practically unchanged at 17 cents, electrolytic copper advanced to 16 1-2 cents by the end of April.

Consumption in this country during the summer months was very heavy, and aided by a fair demand from Europe values were easily maintained. It was not until the end of July that prices commenced to sag, mainly owing to the fact that consumers restricted their purchases to early deliveries.

The ruling quotations in September were 16 1-2 for lake, 16 1-4 for electrolytic and 15 3-4 cents for casting copper. In the meantime, the speculative market in London showed signs of weakness and the reports regarding the state of business in Europe were of a most discouraging nature. Exports of refined copper fell off to an alarming extent, while imports continued to increase and rumors were put into circulation, according to which the leading producing interests were carrying extraordinarily large stocks.

The market recovered from the consequent depression and values kept fairly steady throughout October and November, but it soon became apparent that the Amalgamated Copper Company, which for such a long time had upheld quotations by asking 17 cents for lake and 16 5-8 cents for electrolytic copper, would by force of circumstances be obliged to meet the market. Europe did not send any orders whatsoever; exports were alarmingly small; copper shares on all the exchanges were depressed and stocks continued to accumulate. A sale of a round quantity on private terms, carrying with it as it seems a guarantee of price, was reported at the end of November only to be followed by an open cut of about 1 1-4 cents, thus reducing the quotations to 15 3-8 for lake and 15 cents for electrolytic copper. This was followed by a cut to 14 cents for lake, 13 7-8 for electrolytic and 13 cents for casting copper, and another one to 13 cents for lake copper; 12 7-8 for electrolytic and 12 1-2 cents for casting copper. These prices were freely met by the outsiders, but, naturally, the market was utterly demoralized and business practically at a standstill, consumers preferring to await further developments.

Monthly Average Prices of Copper in New York. In cents, per pound.

	—Electrolytic.—		—Lake.—	
	1900.	1901.	1900.	1901.
January	15.58	16.25	16.33	16.77
February	15.78	16.38	16.08	16.90
March	16.29	16.42	16.55	16.94
April	16.76	16.43	16.94	16.94
May	16.34	16.41	16.55	16.94
June	15.75	16.38	16.00	16.90
July	15.97	16.31	16.16	16.61
August	16.35	16.25	16.58	16.50
September	16.44	16.25	16.69	16.54
October	16.37	16.25	16.64	16.60
November	16.40	16.224	16.80	16.633
December	16.31	13.825	15.88	14.390
Year	16.19	16.115	16.52	16.555

The price given for electrolytic copper is for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.25 cent below these figures.



The quotations at the end of the year are 12 to 12 1-2 cents for lake; 11 3-4 to 12 cents for electrolytic and 11 1-2 to 12 cents for casting copper.

Many explanations have been given for the extreme decline; many threats have been made and many remedies recommended to change the present state of affairs, which is creating havoc, not only in the copper trade itself, but also among the copper consuming industries. It is to be hoped and expected that wise counsels will prevail which will tend to put the market on a safe basis. The attempt to regulate its course by artificial means has certainly proved a dismal failure.

**LAKE SUPERIOR COPPER MINES IN 1901.**

The year 1901 was one of the most prosperous in the history of the Lake Superior copper industry. The production of metal showed an appreciable increase and earnings have been large, owing to a continued high price for copper up to within a few weeks of the end of the year. The number of men employed was somewhat under that in 1900, due partly to a reduction in the working force of the Calumet & Hecla Company, but high wages have continued, and the workmen have little cause for complaint. During the year millions of dollars have been expended for improvements in the way of new mills, new machinery and underground development, and many properties can therefore produce copper cheaper than ever.

The productive Lake Superior copper district is now about 75 miles long, stretching from the Arnold on the northeast, to the Victoria on the southwest. The district is in three counties—Keweenaw County, Houghton County, of most importance with Calumet as its center, and Ontonagon County. For several years prior to 1898 there was little mining in either Keweenaw or Ontonagon County, but the boom which started in that year stimulated the reopening of old mines and the exploration of undeveloped lands. There are at the present time 4 active properties in Ontonagon County and as many in Keweenaw County.

In the fall of 1897 there were only 7 active copper mines in the Lake District, all in Houghton County; at present there are nearly 20 in Houghton County alone. During 1901 there were nearly as many men employed in the copper industry in Houghton County as are now employed in all the copper mines and mills in the entire State of Montana.

The production of refined Lake copper for the past six years has been as follows:

Year:	Pounds.
1895.....	129,330,749
1896.....	142,057,500
1897.....	142,702,586
1898.....	147,965,738
1899.....	146,950,338
1900.....	142,576,313

From these figures it will be seen that the 1900 output fell below that of the preceding year by 4,734,025 pounds, and was the smallest secured in four years. This decrease was caused largely by the fire in the Calumet & Hecla Mine. The production of this year will not be officially known for several months, but it will show a large increase over the 1900 output.

The principal mines have made approximately these outputs for 1901:

	Pounds.
Calumet & Hecla.....	85,000,000
Tamarack.....	20,000,000
Quincy.....	20,000,000
Osceola.....	13,000,000
Atlantic.....	5,000,000
Wolverine.....	5,000,000
Franklin.....	4,000,000
Baltic.....	2,500,000
Isle Royale.....	2,500,000
Mass.....	1,500,000

The Isle Royale and Mass are the only new producers included in the above list. The Isle Royale Mill went into commission last May, while the Mass Mill followed in July. The Centennial, Arnold, Adventure, Phoenix and Mohawk were producers to a limited extent in 1901. The two first secured considerable copper from rock stamped at their mills,

the Phoenix and Adventure from mass and barrel rock taken out in opening ground, and the Mohawk from the mineral mohawkite, an arsenide of copper and nickel.

The dividend disbursements of the lake mines this year are very satisfactory, and outside of the Calumet & Hecla much the largest ever known. The Calumet & Hecla changed the quarterly periods for the payment of dividends, and this year only three of \$15 each were paid. The profits returned to shareholders by the copper mines of Lake Superior, to the close of this year, have been as follows:

Mine:	Dividends.
Atlantic.....	\$880,000
Cliff.....	2,518,620
Central.....	1,970,000
Copper Falls.....	100,000
Calumet & Hecla.....	77,350,000
Franklin.....	1,240,000
Minnesota.....	1,820,000
National.....	320,000
Osceola (including Kearsarge).....	4,389,400
Pewabic.....	1,000,000
Phoenix.....	20,000
Quincy.....	12,870,000
Ridge.....	100,000
Tamarack.....	8,490,000
Wolverine.....	750,000
Total.....	\$113,818,020

This is a showing equaled by few mining fields in the world. Of the total profits returned to shareholders the Calumet & Hecla has furnished almost 70 per cent.

**MINING IN MONTANA IN 1901.**

FROM OUR SPECIAL CORRESPONDENT.

At the close of the year the condition of the Butte copper situation to an outsider is unsatisfactory. The latter months have witnessed a heavy shrinkage in production, by what are considered the big companies of the camp, or those merged into the Amalgamated Copper Company. Several causes are assigned for this shrinkage; one being a reported accumulation of electrolytic, and pig copper by the kindred companies; another, that these companies have been through a long period of active operation, until shafts, and other workings needed retimbering and a general overhauling to make them safe. That a large amount of repair work has taken place lately, in the mines of the Anaconda Copper Mining Company, is well known.

The Boston and Montana is having installed on the 1,200-ft. level of the Leonard shaft, a duplex compound condensing pump, with a capacity of 1,000 gals. for that lift; this pump is intended to drain a large territory of Boston and Montana ground, the 1,200 level of the Leonard, being connected with the 1,100 levels of both Colusa's, and with the 1,500-ft. level of the Mountain View. This is, to date, the most powerful pump ever placed in Butte, or Montana. The water end designed by Master Mechanic Kent of the Amalgamated Copper Company, was cast in Butte of phosphor-bronze, and with pot valve cylinder; the steam part was built by the Nordberg Manufacturing Company of Milwaukee, Wis. The Boston and Montana Smelter at Great Falls, is going through a general overhauling, and enlargement in nearly all departments. It is expected that these improvements will be completed early in January. At Anaconda, the smelter known as the Upper Works, has gone out of commission for good; while the Lower Works is running about two-thirds capacity. Work on the new Washoe smelting plant of the Amalgamated Company is being rushed. This plant, said to be the most complete and modern in the country, will probably be in full operation by spring, as it is now receiving the finishing touches. To say that with the reconstructed works at Great Falls, and the Washoe works in operation the allied companies will be able to cheapen the cost of producing copper, is a safe proposition.

A fire in the smelter of the Montana Ore Purchasing Company last April partially destroyed those works, and somewhat curtailed its output for a short time; aside from that the works have been busy to their capacity, and two converters have lately been added to the converting department. Of the newer copper mining enterprises of the year,

the Farrell Copper Company is the largest, three shafts having been started by that company on the flat a short distance east of Meaderville, one of which has reached a depth of about 600 feet.

The practical completion of two long distance power transmission lines to Butte, is also to be noted. The Missouri River Power Company, has a three wire duplicate system throughout, each three wire line independent of the other. The Amalgamated Company and W. A. Clark contracted for all the available power before the line was started. This line is about 62 miles in length. The Madison Power Company has about completed a three wire single line system from the Madison River; this line is about 63 miles long. This power is also contracted for.

Prospecting for oil in various parts of the state, have in several instances met with encouraging results, and a number of companies have been organized to exploit the finds.

In Beaverhead County, the Greenwood Mining Company has added a 100-ton cyanide (pneumatic process) plant to their concentrator. Two gold dredges put in a satisfactory season's work at the Grasshopper Creek diggings at Bannock. In Granite County the Granite Bi-metallic Company at Phillipsburg, has completed the electric power line from the Flint Creek Dam, and is using electricity at the mines, and at the new 600-ton concentrator now nearing completion. Fergus and Madison counties show good progress. In the former county, the Kendall property on the North Moccasin, was purchased by Finch & Campbell of Spokane, for \$400,000, Mr. Kendall retaining a one-tenth interest. A 200-ton cyanide mill is under construction, which is to be run by electric power from Warm Spring Creek. The Barns-King group of mines, a neighbor of the Kendall, is putting in a cyanide mill, which is in partial operation. The cyanide plants at Gilt Edge, Spotted Horse, and at Maiden, report a prosperous year.

Madison County can point to several new enterprises. At Pony, the Boss Tweed-Clipper Group, was sold to Boston men, at a figure bordering on \$750,000. The property shows an immense body of low grade gold ore, and the new owners are building a 100-stamp gold mill. Not far away is the Fourth of July Group of 8 claims which was recently bought by Butte and Omaha men for \$50,000 cash. A mill is contemplated in the near future.

Other gold properties in the vicinity are being developed. At Rochester, the Watseka has kept its cyanide mill busy, has done more development work in the mines, has greatly improved the machinery equipment at both mines and mill, and is looked upon as a very profitable property. Prospecting for copper has met with encouragement along the Northwest slope of the Tobacco Root Range of mountains, notably in Coal Cañon and Bear Gulch.

The Conway Company will further extend its gold dredging operations by the addition of a powerful dredge built to handle 3,000 yards of gravel per day. The Montana-Milwaukee Mining Company at Sand Creek has in operation a complete 15-stamp gold mill just finished.

In Lewis & Clarke County, at Empire, the Gold Belt Mining Company has completed a 500-ton cyanide mill to treat the big accumulation of tailings from the 60-stamp mill that was worked by an English company. The plant of the American Smelting and Refining Company, at East Helena, made extensive improvements early in the year, costing about \$200,000, and is now adding two additional stacks to the equipment, making it one of the most important plants of the company's system, and one showing good profits for the year.

A deposit of corundum in Gallatin County, which has the appearance of being of considerable extent is a recent mineral find. The mineral occurs in well-formed crystals imbedded in the matrix, and generally without fracture. A company will develop the property.

The American Gem Company, purchased during the year the Burke & Sweeny sapphire ground in

Yogo Gulch, Fergus County. The sapphire crystals are found in the original matrix in a dyke of trap rock cutting the limestone. This company also mined for sapphires on Rock Creek, in Granite County. During the year, a number of fine sapphires were found on the Dry Cottonwood, in Deer Lodge County.

Experiments with cyanide, during the year have demonstrated that by the improved methods, many ores are susceptible to that process, that have not yielded successfully to other treatment.

A number of companies have been doing development work in the Swift Current District, on the ceded portion of the Blackfoot Indian Reservation, where good indications for copper are claimed. Mining in the western portion of the State has been active, and several large enterprises are under development.

#### LEAD IN 1901.

In the year 1900 the lead production of the United States reached the highest point on record. The output of that year was 275,907 short tons, of which 221,278 tons, or 80.2 per cent, were classed as desilverized lead; 47,923 tons, or 17.4 per cent, were soft lead carrying no silver; and 6,706 tons, or 2.4 per cent, hard or antimonial lead. The mines of the Coeur d'Alenes, in Idaho, produced about one-third of the ores from which the desilverized lead was smelted; Leadville, the San Juan and other districts in Colorado, furnished another third; while the remainder came from Utah, Montana and other States in the West. The soft lead came chiefly from Missouri, by far the larger part from the Southeast Missouri District, where lead ores only are mined, and the rest from the Joplin District, where lead is obtained in connection with the zinc ores, which are the chief product of the region.

The great production of 1900, which exceeded that of 1899 by 58,822 tons, was not fully absorbed by consumers, and we entered the year 1901 with stocks on hand estimated at about 67,000 tons, or nearly three times the quantity shown in the five preceding years. These large stocks and a sharp falling off in the foreign demand led to some curtailment in production during the year, though the domestic consumption remained very large all through the year.

The production of lead from ores mined in the United States in 1901 cannot yet be exactly stated, but the data at hand point to a total of approximately 265,000 short tons, or some 10,000 tons less than in 1900. The decrease was in silver-bearing lead, the production of which was some 20,000 tons less than in the preceding year, the loss being distributed somewhat unevenly, the greater part being in ores from the Coeur d'Alenes. The mines in that region are now mainly consolidated, and under the control of a few large companies, and their output can be regulated with comparatively little difficulty. The Leadville mines, in Colorado, kept up their output, as shown on another page, while the Utah reports of ore shipments indicate an increase in that State. In the lesser districts in Colorado there was some falling off.

In the soft lead region of Missouri, on the other hand, there was much activity throughout the year, and a considerable increase in the mining and smelting of ore. The total output of soft lead showed an increase of probably 10,000 tons, and this reduced the loss in the total lead production of the United States to about 10,000 tons, as stated above.

The American Smelting and Refining Company practically controls the production of desilverized lead, owing to the very large proportion of the metal which passes through its smelting and refining works. It continued to improve those works during the year, and further important changes are pending in several of its plants which will increase their efficiency.

The work done in the Missouri lead districts is described in the separate article which follows.

**Other Countries.**—The depressed condition of business in Europe and the lighter demand for lead,

as for other metals used in construction and in manufactures, has had an unfavorable action on the production of lead abroad. Spain, which was formerly the leading lead producer of the world, and has been passed by the United States only in very recent years, felt the crisis severely, and during the later months of the year some reduction is reported.

In Australia the Broken Hill Mines did not increase their output, and the low prices of lead combined with the fall of silver, brought before the smaller mines the alternative of closing down, or working at a loss. Some of them have adopted the former course.

The Mexican mines showed some reduction in output, the causes of which are referred to in the article on "Silver" on another page.

In short, the lead industry has not been prosperous outside of the United States, and the effect of the existing conditions will be evident during 1902.

#### THE NEW YORK LEAD MARKET IN 1901.

Little can be said about the lead market during the past year, but all that can be said is telling. The American Smelting and Refining Company, controlling practically the entire output of desilverized lead in the United States, pursued a broad policy, and for over a year kept the market at a uniform price, the basis being 4 $\frac{3}{8}$  cents New York, or its equivalent, notwithstanding a heavy supply of lead ores, larger than ever before in the history of the country.

In order to carry the operation through, recourse had to be taken to certain expedients. First of all, some domestic lead was exported to Europe, but when the European market fell off from £17 10s. in November, 1900, to £12 3s. 9d. in April and £10 15s. early in December, this operation was too costly. Thus, last Spring, arrangements were made with the principal producers of lead ores to reduce their output, and enormous royalties were paid for quantities not mined, to pacify the recalcitrant miners.

In all of these operations, the stocks on hand increased, and when early in December the London market declined to £10 5s., the broad policy had to be abandoned, owing to the danger of foreign lead—even with a duty of 2 $\frac{1}{8}$  cents per pound—being imported into this country.

Then the price was suddenly reduced to a basis of 4 cents, New York.

Meanwhile, the production of chemical and soft Missouri lead, fostered by the high prices, increased materially, and was all marketed.

Vast improvements are being made in Missouri to lessen the cost of mining the rich lead ore deposits which exist there, and it will not be long before the production from that section will increase very materially.

The heavy stocks which have accumulated are held by the American Smelting and Refining Company, as consumers are carrying on their business with the lowest possible supplies.

The past year has shown an attempt on the part of two strong corporations to manipulate two of the most important metals known, to the benefit of their own interests. The Amalgamated Copper Company tried it with copper; the American Smelting and Refining Company with lead. The situation in both

Monthly Average Prices of Lead in New York. In cents, per pound.

	1900.	1901.
January .....	4.680	4.350
February .....	4.675	4.350
March .....	4.675	4.350
April .....	4.675	4.350
May .....	4.181	4.350
June .....	3.901	4.350
July .....	4.030	4.350
August .....	4.250	4.350
September .....	4.350	4.350
October .....	4.350	4.350
November .....	4.350	4.350
December .....	4.350	4.153
Year .....	4.370	4.334

metals became worse as time rolled on. Heavy stocks accumulated. The collapse came in December to the detriment of both companies. History has repeated itself.

#### THE SOUTHEAST MISSOURI LEAD DISTRICT IN 1901.

FROM OUR SPECIAL CORRESPONDENT.

The southeast or St. Francois Lead District of Missouri consists of St. Francois County, with extensions on the South and West into Madison and Washington counties. The producing mines thus far developed all lie within a belt some 30 miles in length, with a maximum width of 3 miles. The ores are exclusively galena or the sulphide of lead, and no zinc ore is associated with them, as in the case of the Joplin or Southwestern District, where the zinc is the main value.

The ore occurs disseminated in horizontal shoots in Cambrian limestone, at depths of 100 to 500 feet. The ore-shoots are very persistent, usually of large size, but always of low grade, averaging a yield of 3 to 4 per cent lead, and therefore have to be concentrated. As the disseminated ore never outcrops prospecting has to be slowly carried on with the diamond drill, so that the real merits and magnitude of the district are only just becoming known. Most of the mines are less than 10 years old, and the oldest is only 35 years.

The year 1901 continued the substantial growth of the past 10 years, as the output will closely approach 50,000 tons of lead, or approximate over \$4,000,000 in value, while the output of 1902 promises to show a still larger increase.

The St. Joe Mine has just increased its milling capacity 40 per cent; its No. 11, or Hunt Shaft, has begun producing, while its No. 12 or Hoffmann Shaft has just been completed. The Doe Run Mine is sinking two new shafts that will be completed in 1902. The Desloge Mine is sinking a new shaft (No. 4), and is erecting a large new smelter at the mine. The Central Mine has enlarged its smelting capacity, and its new, or No. 3, shaft has begun producing. The Catherine Mine has become a producer, and has completed a new, or No. 2, shaft. The National Lead Company has started work on a third shaft that should materially increase its production. The new Federal Lead Company has completed its No. 1 shaft, and its new 500-ton mill is expected to start by next spring, thus becoming a producer. The Derby Lead Company has at last completed its No. 1 shaft, and expects to finish its No. 2 shaft in 1902, after many and expensive delays. The Irondale Mine has finished its first shaft and about completed a 200-ton mill, so it should become a small producer in 1902. The Buckeye Company has completed its first shaft, but as no mill has been started, it is not likely to produce any lead before 1903.

The Federal Lead Company has started a large new smelter at Alton, Ill., preferring to take the lead concentrates, about 80 miles to the coal-field, instead of the coal to the mine, as has been the previous practice in this district.

Prospecting in search of new ore-bodies is being actively carried on by all the old companies, as well as by several newer companies, both in the lead belt and in the surrounding territory. While some valuable new strikes have been made within the belt no workable deposits have thus far been found in the outlying territory, except at Irondale, though as the latter has not yet begun to produce, its value is still uncertain.

#### ZINC IN 1901.

The production of zinc undoubtedly showed an increase in 1901 over the total of 123,381 short tons reported in 1900. The gain was mainly due to the activity of the mines and smelters in Southwest Missouri and Southeast Kansas—the Joplin District—which, in 1900 furnished 63 per cent of the total production of the United States, and increased that proportion last year. In the Illinois-Indiana Dis-



tract there was little or no progress, though some was made in the East.

The conditions affecting the zinc smelting industry and the markets for the metal are fully treated in the special articles which follow.

### ZINC SMELTING IN THE UNITED STATES IN 1901

By WALTER RENTON INGALLS.

The year 1901 has been signalized by a relatively low range of prices for spelter in Europe, notwithstanding the increased cost of coal to the smelters of Belgium and Germany. Since January 1 the quotations in London have been steadily below the point at which exports could be made profitably from the United States. During the first six months the average price was 3.84 cents per pound at St. Louis, 4.02 at New York and 3.78 at London. In the second half of the year the London price continued low, but an increasing demand for domestic consumption enhanced somewhat the value of spelter in this country, especially during the last quarter of the year. However, the average price of spelter in 1901, both in America and Europe, has been lower than the general average of the ten years 1891-1900.

The low prices for spelter, with which the prices for standard ore at Joplin, Mo., correspond more or less closely, appear to have had no tendency to restrict the production of ore in the Joplin District, where the output was 133,866 tons during the first six months of the year; for the 50 weeks ending December 7 it amounted to 245,000 tons, which would indicate an output of 255,000 tons for the year. The production of the district was 242,500 tons in 1900; 256,456 in 1899; and 235,123 in 1898. It is especially worthy of remark that the production in 1901 has certainly exceeded the average of 1898-1900 (approximately 245,000 tons per annum) and has probably equalled, if not surpassed, that of 1899, which was a year of phenomenally high prices. It appears therefore that with a price of \$24 to \$25 per ton for ore assaying 60 per cent zinc, the Joplin District promises to maintain and even to increase its present large output, although the profits in mining are greatly diminished as compared with those which were realized in 1899 and 1900.

As a matter of fact, the average profit in producing zinc ore in the Joplin District when the standard grade of concentrates fetches only \$24 to \$25 per ton cannot be very large, although even that price is in excess of the general market of only a few years ago. However, it should be considered that the average grade of the crude ore milled has probably decreased, while the cost of mining has increased to an extent which has not been offset by the improvements in the milling practice as the easily accessible ore deposits lying near the surface have gradually been exhausted. A good deal of complaint is heard from the Joplin miners with respect to their present small profits and there is undoubtedly a basis for them, allowing for the natural tendency of ore producers to grumble at what they receive for their product, but the conditions which lead to narrow margins appear to be entirely natural. The chief of those conditions are the low grade of the ore which is mined and the law of supply and demand which establishes the price of spelter.

Mining in the Joplin District in 1901 has been without any radically new features. The limits of the district continue to be undefined and there are still extensive unexplored areas in which zinc ore is likely to be found. In 1901 new discoveries of ore have been made in the country southeast from Joplin, toward Granby. The mining and milling practice remains the same as in the previous year, but expenses have been increased somewhat by a further rise in the cost of coal, the prices of mine-run and lump having been raised September 1 from \$1.40 and \$1.55, respectively, to \$1.60 and \$1.75 per ton. The practice in mining and milling appears crude to the newcomer in the district, but it is the concrete result

of the experience of many men extending over many years, which has evolved a system peculiarly suited to the local conditions; and although it appears possible at first sight to reduce further the already phenomenally low cost of milling, and especially to increase the percentage of mineral saved from the crude ore, the experience of mining men trained in districts where different methods are employed, who have tried to introduce fancied improvements in the Joplin practice, has led to the conclusion that it is safest to leave the latter to evolve itself gradually. The tendency in the milling practice appears to be toward the production of the highest grade of ore that is possible, that being the kind which is most keenly bid for by the smelters, and the output probably averages higher for the whole district than a few years ago. The standard ore of 60 per cent grade in zinc contains only about 8 per cent of siliceous gangue, which would be considered ordinarily an extremely high degree of concentration, but a good deal of ore assaying 62 to 63 per cent zinc is now produced and certain mills make a product assaying as high as 64.5 per cent zinc, which falls a little short of being pure blende. A good deal of attention has been given during 1901 to the magnetic removal of iron from certain classes of ore, rather high in pyrites, which have not heretofore found a ready sale at remunerative prices. New magnetic separators, namely, the Cleveland-Knowles and the Waring, both of them Joplin inventions, are being exploited with encouraging results. A new factory for the manufacture of zinc white has been erected at Joplin during the year; the raw material is a zinc carbonate assaying about 37 per cent zinc, which comes from what is supposed to be a large deposit at West Plains, Missouri.

In the zinc smelting industry the great centre of operations is now the Iola District, comprising the environs of the town of Iola and the near-by towns of Gas City and La Harpe. Outside of that district the only large smelting plant is that of the Edgar Zinc Company, at Cherryvale, Kansas. The old plants at Pittsburg and Weir have been idle throughout the year. A few furnaces have been in operation at Girard, while the small works at Bruce has been run upon Colorado ore, effecting the distillation in Sadtler retorts, to which more specific reference will be made further on.

The Lanyon Zinc Company and George E. Nicholson, both at Iola, and the Edgar Zinc Company, at Cherryvale, have added new furnaces to their plants. A new plant of 1,800 retorts has been erected by A. B. Cockerill, at Gas City, near the existing plant of the Prime Western Spelter Company. Another new plant, comprising a sulphuric acid department, has been erected by the Standard Acid Company, at Iola, near the Nicholson works. The ore is to be roasted by means of a modification of the Hegeler furnace and the acid department is designed to turn out a product of 60° B strength. At least one other new plant is contemplated for erection in the Kansas gas field in 1901. The American Smelting and Refining Company is already arranging for the erection of a zinc smelting plant at Pueblo, Colo., which will afford a local market for the blende concentrate of Leadville, Kokomo, Montezuma, Creede, Rico and elsewhere in Colorado. The Lanyon Zinc Company and the New Jersey Zinc Company have been building rolling mills during the year (at La Harpe, Kan., and Palmerton, Pa., respectively) which must each be nearly ready for early operation. The outcome of the advent of these concerns into the sheet zinc business, wherein the Matthiessen and Hegeler Zinc Company and the Illinois Zinc Company have heretofore had an extremely profitable monopoly, is awaited with interest.

Recent improvements in the metallurgical practice of the Kansas smelters has been in the line of bettering it in details rather than by the introduction of any radical innovations. The sharp competition of the last year or two has put an end to slovenly practice and caused the smelters to stop various small leaks in their expense accounts and improve the per-

centage of metal saved from the ore. In the latter respect the results at present attained are good, whereas only two years ago they were decidedly inferior. Inasmuch as the recovery of an additional percent of metal from ore assaying 60 per cent zinc is equivalent to a gain of approximately 50 cents per ton of ore at the ordinary price for spelter, the importance of attention to that matter is apparent, especially when the cost of smelting per ton of ore has already been reduced to such a point that it is difficult to shave it further. During the last two years a good many of the developments in smelting with natural gas which previously had been tentative and experimental, have crystallized into a definite practice, which may be considered as dating from the present year, the first year of the new century.

The Iola smelters have settled upon a type of forced draft distillation furnace, which was originally adapted from the long furnaces employed at LaSalle, Ill.; after many vicissitudes and reconstructions, it has been modified so as to give satisfactory results with natural gas firing. At Cherryvale alone furnaces operated by natural draft are employed, following the type adopted in the Indiana gas field, but better designed and more substantially constructed. The Indiana type has also been tried experimentally at Iola during the past year, but has been discarded in favor of the forced draft furnace, or "blow" furnace, as it is commonly called. There is no doubt that the conclusion of the Iola smelters rests upon sound grounds, both as to result of experience and the indication of theory, since the introduction of air by positive pressure, if properly regulated, ought to enable a better control of combustion than the uncertain regulation of the air supply induced by means of a chimney.

The distillation furnaces now commonly in use at Iola comprise from 600 to 660 retorts, arranged in five rows of 60 to 66 each per side. The introduction of any portion of the gas through the end wall of the furnace has been discontinued, and the entire supply is now fed in through ports in the alternate pillars of the working sides of the furnace, the gas being brought down through branch pipes from the mains extending along the furnace for the full length of each working side. The omission of four tiers of retorts at one end of the furnace (in order to afford the gas and air formerly introduced at that end of the furnace an ample opportunity for mixture before reaching the retorts) has also been abandoned, and in those furnaces already constructed in that manner the former open space is now occupied by additional retorts, wherefore a furnace that used to contain only 620 retorts now has 660. The old furnaces have also been generally repiped, giving them a larger gas supply, a better distribution of gas and better means of regulating its influx, together with that of the air for its combustion, and consequently a better control of the temperature. The result of these improvements has been a complete elimination of the old trouble of soot deposition, which was, of course, due simply to a deficiency in air supply or to imperfect admixture of the air and gas, while a uniform temperature throughout nearly the whole length of the furnace is attained and can be maintained as desired, of course with a beneficial effect upon the yield of metal obtained from the ore. Not less in importance is the better systemization of the labor in distillation, which has enabled the maneuver, i. e., the discharging and recharging of the retorts and the accessory processes to be performed within the customary limit of five hours, or in but little excess over that time.

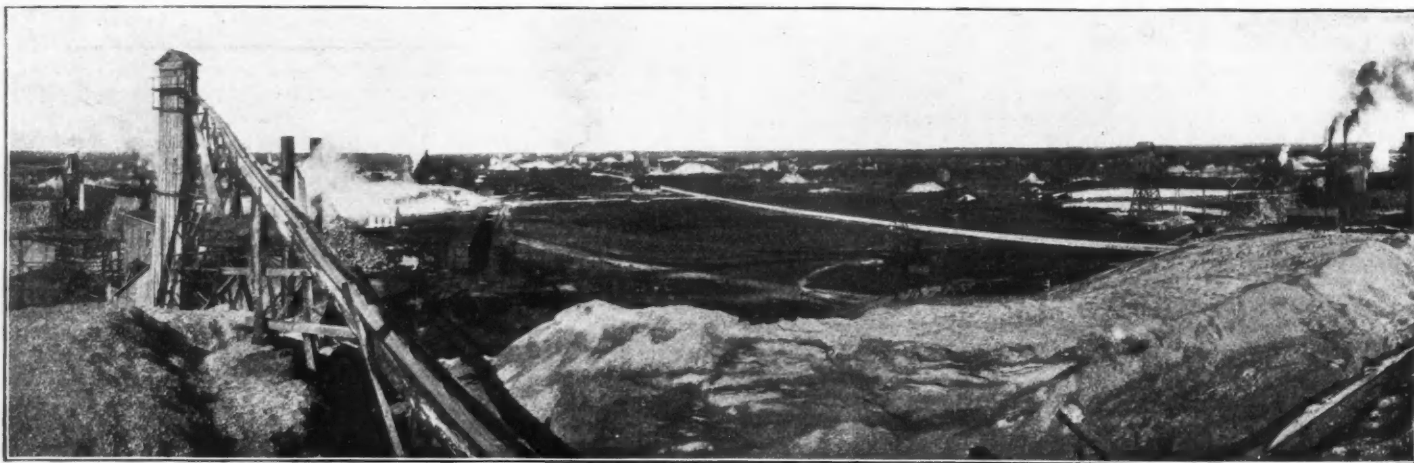
The physical construction of the furnaces has also been improved, many of the older ones with entirely too light walls and imperfect bracing having been torn down and replaced by furnaces of more substantial and better ironed masonry. This has led naturally to an increased length of furnace campaign. It is probably still too early to determine what will be the average duration of furnace campaign at Iola, inasmuch as gas smelting there is not yet more than five years old and it is only within the last two years that practice has definitely crystallized,

b there seems to be no reason why the average should not exceed two years and with good construction in the first place and subsequent careful attention it may be fully three years. The form of furnace with a single large, light and airy ash-tunnel is generally adopted, none but the furnaces at La Harpe having two tunnels, but the chimneys instead of being built in connection with the end wall of the furnace, resting on the arch of the ash-tunnel, as was the case of some of the earlier furnaces, are now set a few feet in advance of the end wall and offset from

from the ash-pockets and accumulated in unsightly heaps in the old way. It is likely, moreover, that some improvements can be made in delivering the air supply to the various furnaces. In the present practice the blowers, of the ordinary fan type, are situated in the main engine house. Each works is provided with at least a duplicate installation and it is the common practice to run one fan by day and the other by night. In large works the air has to be conveyed a long distance in order to reach the more remote furnaces and it appears as if the piping

aid of natural gas in the Iola District, both with hand-raked and mechanically-raked furnaces, is phenomenally low.

The quality of the spelter produced is a matter which receives careful attention, particularly in order to meet the requirements of the brass trade. Some of the smelters keep apart the first drawing of metal from the condensers and cast it in 50-lb. slabs which are sold under the names of "extra select," "brass special" or some other particular brand. Metal of that class con-



MINES NEAR JOPLIN, MO., ON GROUND WHICH WAS BARE PRAIRIE THREE YEARS AGO.

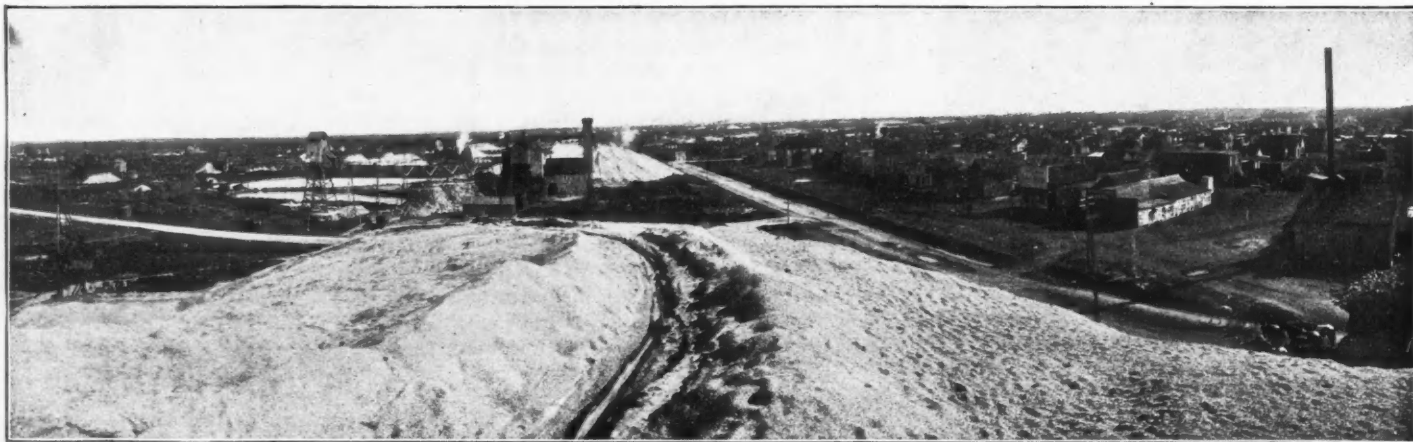
the prolongation of the lines of the combustion chambers, so that they stand on a solid foundation independent of the furnace proper and at the same time leave the ash-tunnel clear, connection between the combustion chambers and their respective chimneys (two per block) being made by short horizontal flues. Another detail in which there has been a change is the removal of the gas regulator to a point 40 to 50 feet outside of the furnace house, the advisability of this having been indicated by the explosion of a regulator in one case, ignition of the escaping gas and destruction of the furnace and house. The furnace houses are designed after the same general type

were not always installed so as to insure the maximum economy of power and regularity of air supply.

Although the furnace of the dimensions described above has become the Iola standard, the Lanyon Zinc Company has been trying during 1901 some furnaces of the same type, but with only 400 retorts, these being arranged in five rows of 40 each per side. Two furnaces of that size are installed end to end, with proper space between them, in a single house, giving thereby 800 retorts per house. The fact that the Lanyon Zinc Company has been building some additional furnaces of the same dimensions indicates that

tains but little more than 0.5 per cent lead and is generally safely within the iron limit. The ordinary product of the Iola smelters is marketed in the form of slabs weighing 65 to 67 pounds, or roughly 30 to the ton.

The profit in the smelting business depends a great deal upon the judgment with which the ore supply is purchased. This involves good management at the works and skillful knowledge on the part of the ore-buying agents in the Joplin District. It is the consensus of opinion that the best profit in smelting is obtainable from the superior grades of ore and the competition is therefore keenest for them. One con-



TOWN OF CHITWOOD, NEAR JOPLIN, MISSOURI.

throughout the district. This is a long frame building with a simple pitch-roof supported by posts (no trusses) which are disposed in such a way as to leave an ample clear space in front of the furnace. The distance from the working faces of the furnace to the sides of the building is sufficient to enable work to be done with comparative comfort notwithstanding the intense radiation of heat from the long furnaces. The floors of the buildings are paved with brick and the ore is brought in by means of large charging cars on tracks extending in front of the furnace on each side. Movable shields to aid and protect the men in working the furnace are used at all the works without exception. No attention has yet been given, however, to economical removal of the residues discharged from the retorts, which are wheeled away

the results of the first ones were satisfactory. It is naturally to be expected that modifications in the number of retorts per furnace and their arrangement will be made from time to time, but there seems to be little probability that a further change from the Iola type of furnace as a type will have to be made so long as the supply of natural gas continues to be ample.

In the blende roasting practice conditions remain the same as heretofore, some of the works employing long mechanically-raked furnaces and some of them continuing to use hand-raked shelf burners. The new works of the Standard Acid Company has a modification of the Hegeler furnace, which is adapted to utilization of the sulphurous gas for acid manufacture; the new plant of A. B. Cockerill has hand-raked shelf burners. The cost of roasting with the

cern which is especially fastidious has gone so far as to have one ore buyer per 5,000 tons of ore purchased per annum, but that is rather extreme; one of the largest companies employs one man per 15,000 tons purchased. The comparatively small quantity of silicate ore which is offered is purchased by some smelters and used in their furnace charges to the extent of 8 to 10 per cent; others do not buy it at all, holding that there is more money to be made from a judicious admixture with high-grade ore of a proportion of inferior sulphide ore at the price for which the latter is obtainable as compared with what the silicate ore commands; others still buy only high grade ores.

The year 1901 has witnessed what is practically the end of the direct-firing coal smelteries of Missouri and Kansas, at least for the present or so long as



the natural gas holds out. Several of the old plants which were closed in 1900 have been dismantled this year; others are being permitted to fall gradually to pieces by idleness and decay; there is little likelihood that any of them will be of further use in their present form. The few coal smelteries that have been in operation during the year comprise the works at Collinsville, Ill. (which were closed in August), the Carondelet Works of the Edgar Zinc Company and the small plants at Girard, Kan., and Rich Hill, Mo. It may be remarked incidentally that the works at Girard and the two plants of the Edgar Zinc Company are controlled by the United States Steel Corporation, which obtains therefrom about 25,000 tons of spelter per annum, or about 50 per cent, more or less, of its own requirement of spelter for galvanizing purposes.

An interesting development of 1901 has been the practical application of the Sadtler retorts\* at the works of the Midland Smelting Company, at Bruce, Kan., which were leased by the owners of the patents for the purpose of demonstration. Operations were begun June 10, since which time ore high in lead and

& Kansas Zinc Miners' Association, which is composed of leading zinc ore producers of the district. The association claims that American zinc ore is preferred to the European product, on account of its quality.

The rumors of a combination of American zinc smelters has not in the least affected the local market. Members of the producers' association are, almost to a man, of the belief that such a combination will be compelled to come to terms with the producers and that the terms will be equitable for all parties concerned.

The lead ore production of the Joplin District has almost been forgotten in the excitement attendant on the fluctuations of zinc ore and its advance in the past few weeks. The year closes with the industry active and the price a comparatively fair one. Lead ore is bringing \$23.25 per 1,000 lbs., delivered. This price has been paid without variation during the past three months, and while below the average for the year, yet the demand is good and none is allowed to remain in the bins at the end of each week.

The value of the zinc and lead ore production in

shafts in a desultory manner and abandoned have within the past year been reopened with great profit. Land which was condemned has been found to be among the richest of the district. In this connection a wealthy pioneer miner and landowner, who has seen the City of Joplin with its 30,000 inhabitants and metropolitan improvements grow from a grassy prairie, stated that he only knew of one tract of land which he believed to have been thoroughly prospected, and that tract contained only 40 acres. Mineral land within the city limits of Joplin has been re-opened after a decade of idleness by a more thorough search for ore bodies.

Another remarkable illustration of this fallacy was the development of 80 acres by the United Zinc Company, one-half mile west of Joplin. This company commenced the development of a property which had at three different times been given up as a failure. To-day 10 producing mills are upon the tract and since the systematic development began the property has produced over \$1,000,000 worth of zinc and lead ore. The adjacent territory is dotted with immense producers as a result of this demonstration and a



GROUP OF ZINC ORE MINES, THE "CIRCLE PROPERTIES," AT ORONOGO, MO.

iron from Colorado, together with some ore high in iron from the Joplin District, has been regularly smelted, apparently with successful results. I am informed that at least one other smelter in Kansas intends to give the Sadtler retorts a trial in 1902.

**THE JOPLIN ZINC AND LEAD DISTRICTS IN 1901.**  
BY OUR SPECIAL CORRESPONDENT.

The close of 1901 in the Joplin zinc and lead district shows an increase in tonnage over that of any previous year in the history of the district. The value of the production was only excelled by the year 1899, when the value of zinc ore was advanced fictitiously. During the month of April of that year zinc ore was sold for the phenomenal price of \$55 per ton. This is the highest price on record for that ore and was brought about by a temporary shortage and dissension among the American smelter men, as well as a fear that European smelters might take much of the production. From that time a gradual settling process took place, which resulted in zinc ore declining to \$24 per ton. At the beginning of 1900 the price was close to \$29 per ton, and after a two months' fluctuation around that figure dropped to the \$25 per ton mark. The year 1901 opened with a depressed market around these figures and up to within the past three months the lethargy had not been thrown off. From that time to the close of the year zinc ore slowly climbed until the product is now selling for \$32 per ton.

One of the principal factors in the recent advance of zinc ore is the export movement. At present zinc ore is in transit to Belgium and Wales. European representatives are on the ground competing for ore, but purchasers are reticent about the amount yet to leave. The purchases are made through the Missouri

the Joplin District for 1901 is a little more than \$8,000,000. The zinc ore tonnage was 515,000,000 pounds, and lead ore slightly above 70,000,000 pounds. This is an increase of 15,000,000 pounds of zinc ore and 10,000,000 pounds of lead ore and \$15,000 in valuation over 1900.

The year 1901 was not characterized by the expenditure of money in development. The number of new mills is small, but the number of innovations are numerous and far reaching in effect. Many of the poor business policies have been weeded out, and science has played a more important part in the operations than ever before. The legitimate progress was hampered to a degree by a number of frauds whose clients were victimized into buying inflated stock. This policy is being suppressed to a great degree and zinc mining stocks are again finding favor.

It is a notable fact that almost every wealthy pioneer of the district owes his fortune to the acquisition of mineral land in fee and large leaseholds, and where the large corporations have followed this plan they have almost invariably been successful. A notable illustration of this rule is the Granby Mining and Smelting Company, organized in 1865. This is one of the oldest and largest concerns of the district, and continues to be in the market for zinc properties. It has acquired over 15,000 acres of mineral land in the district and the properties have produced over \$30,000,000 worth of zinc and lead ore, and continue to produce at the rate of \$1,000,000 a year.

Another feature of the year's progress was the demonstration to a remarkable degree that the shallow runs of ore which are now mined cannot be prospected too thoroughly, while runs that are known to exist much deeper are not prospected at all. Many tracts which have been prospected by drills and

village and community of 2,000 souls have clustered in the camp, which is known as Chitwood.

Another feature of the year's progress is the effort which was instituted to secure aid from the State in demonstrating the ore formation at lower levels. At present the deepest deposit being worked is about 250 feet, while the average is about 100 feet. Larger bodies have been found at various lower depths, but the State has been asked, and will probably comply, to a request to demonstrate the strata officially. The following is a table of the best known record of the various depths to which prospect drilling has been done:

Number of holes drilled	Depth feet	Per cent found ore	Number of holes drilled	Depth feet	Per cent found ore
500	50	3	8	700	None.
450	100	8	7	800	None.
400	150	25	6	900	50
125	250	34	6	1,000	None.
100	300	None.	2	1,100	50
25	400	None.	2	1,200	None.
12	500	75	2	1,400	None.
8	600	50	1	2,005	None.

While Joplin is the metropolis of the district, yet the activity is widespread and growing more so day by day. The district embraces Jasper, Newton, Lawrence, Dade, Greene and Christian counties in Missouri and Cherokee County in Kansas. Jasper County, in which Joplin is located, is almost the geographical center of the district.

Another notable feature of the district's progress is the increasing facilities. One new railway has entered the district within the past year and surveys for three others have been completed, with additions of a number of branches to the old systems. The region is traversed by a network of steam and electric lines almost unknown in any other section. The year produced a wonderful advance in the development of the natural resources adjacent; such as fuel and timber, and mining operations have been accelerated to a marvelous degree thereby.

\*See ENGINEERING AND MINING JOURNAL, September 29, 1900.

**THE NEW YORK SPELTER MARKET IN 1901**

The market has been very steady throughout the year, and has not been subject, as in former years, to wide fluctuations. With the exception of a few isolated lots, shipped early in the year on old contracts, no spelter was exported; neither would the European market have been in a position to take additional quantities from this side without depressing prices still further, for in consequence of the lessened consumption on the Continent and in England, European producers felt compelled to reduce production, in order to guard against a further decline in values. It seemed absolutely necessary for the foreigners to take recourse to such concerted action, in view of the fact that the spelter industry had entered a phase which meant severe losses.

The unprecedented advance in the price for coal and higher wages—but more particularly the former, which were established during the last two years—added heavily to the cost of producing the article, and the result was in most, if not all cases, that producers were doing a losing business. Under these circumstances it was a matter for congratulation that our domestic demand proved fully sufficient to absorb the entire production of the United States.

In spite of the steel strike, the galvanizing industry, which forms the principal outlet for the consumption of the metal, was very active with but short interruptions. The sheet zinc business was satisfactory in price as well as volume, and the brass trade too consumed considerably more than at any previous year. The many avenues through which spelter enters into use for electrical purposes, such as telegraph and storage batteries, called for larger quantities, as did also that industry in which zinc oxide seeks its outlet.

On the other hand, the output of zinc ores continued very large, although several of the companies floated a year or two ago, met with disaster. While some shipments of Joplin ores were made to the other side, mainly with a view to stimulating competition, the capacity of the smelting plants now in operation is more than sufficient to treat the present output. Colorado has supplied a moderately large tonnage of ores and indications are that shipments from that direction will show a large increase during the coming year.

January opened rather dull at about 4 1/4 cents New York, consumers pursuing a hand-to-mouth policy, but producers not pressing sales. As the year progressed, the market weakened, in spite of a shut-down of about 60 per cent of the mines and a good consumption; and 3.75 cents St. Louis and 3.95 cents New York was reached by the middle of February. From this figure there was a slight recovery, only to give way to renewed depression.

During April, however, some speculative buying set in and the market displayed considerable activity. Quotations of 3 7/8 St. Louis and 4.05 cents New York were reached in June.

During the summer months, the steel strike prevented any undue upward movement, and it was not until about the middle of September that matters began to improve. A lively demand developed for early shipments and prices advanced to 4 1/4 cents New York in October, and 4.32 1/2 cents in November.

Monthly Average Prices of Spelter in New York. In cents, per pound.

	1900.	1901.
January	4.65	4.13
February	4.64	4.01
March	4.60	3.91
April	4.71	3.98
May	4.53	4.04
June	4.29	3.99
July	4.28	3.95
August	4.17	3.99
September	4.11	4.08
October	4.15	4.23
November	4.29	4.29
December	4.25	4.31
Year	4.39	4.08

The closing figures at the end of the year are 4.15 cents St. Louis and 4.30 cents New York, with

stocks in first hands comparatively small. Negotiations are under way with a view to a consolidation of the principal smelting works, but owing to the proposed enormous capitalization, well informed parties doubt that the scheme will materialize.

**TIN IN 1901.**

The United States produced no tin in the year 1901, and in this respect the report does not differ from that of previous years. This country is a large consumer of tin, but its supplies are entirely imported, the larger part coming from the mines of the Malay Peninsula, which ship through Singapore. Straits tin, as this tin is called in the market, is the leading brand here.

For the eleven months ending November 30 our imports of tin into the United States are reported at 30,377 long tons, an increase of 1,961 tons over 1900. Of this year's imports 17,649 tons came directly from the Straits, 242 tons from Australia and 260 tons from other countries; while 11,139 tons, almost all Straits tin were imported by way of Great Britain, and 1,087 tons—chiefly Banka and Billiton ton—by way of Holland.

As in previous years there have been reported discoveries of tin ore in various parts of the United States; but none of them have proved upon fuller investigation to be of value.

The world's supplies of tin come chiefly from countries in which no accurate mining statistics are available, and figures must be based largely upon the exports and imports recorded. The statement below is based upon the facts collected by the *Metallgesellschaft* of Frankfort, and by Messrs. Richard & Freiwald, of Amsterdam. They cover the 12 months ending November 30, and are believed to show with a close approach to accuracy, the production and consumption of tin during that period.

The following table shows the estimated consumption of tin for two years, as measured by the deliveries; the figures being in long tons, of 2,240 pounds:

	1900.	1901.	Changes.
United States	29,050	31,950	I. 2,900
Great Britain	25,353	25,540	I. 187
European Continent	23,412	23,944	I. 532
India and China	1,785	2,100	I. 315
Other countries	500	550	I. 50
Total	80,100	83,184	I. 3,084

There is necessarily some degree of uncertainty in this distribution, since it is not always possible to trace small shipments made through British and Dutch ports. The shipments to South America are also an uncertain quantity. It must also be remembered that this statement takes account only of the raw tin, and does not include shipments made from Great Britain and the United States in the form of tin plates; such plates being usually classed under iron and steel.

It will be seen that the United States is now the largest consumer of tin in the world, and took last year 38.4 per cent of the total. This is due to the rapid development of our tin-plate industry.

What are known as the visible stocks—that is, tin known to be in warehouse or on ship-board—were estimated at 18,493 tons on December 1, 1901. Of these stocks, 5,359 tons were in the United States, or on shipboard bound for this country.

The estimated production of tin for the year ending November 30 is shown in the following table, also in long tons:

	1900.	1901.	Changes.
Straits (Malay Peninsula)	46,526	51,757	I. 5,231
Banka	12,631	14,978	I. 2,347
Billiton	5,678	4,410	D. 1,268
Australia	3,300	3,495	I. 195
Bolivia	6,000	6,000	....
Cornwall, England	4,268	4,050	D. 218
Total	78,403	84,690	I. 6,287

In 1901, for the first time in several years; the estimated production of tin exceeded the consumption. Stocks have been gradually decreasing and the available surplus has now practically disappeared.

It will be seen that the greater part of the increased production in 1901 came from the Straits. The tin

deposits of the Malay Peninsula show no present signs of exhaustion, and their known area is being extended by new explorations. In fact the production has been limited chiefly by the labor available. That labor is chiefly Chinese, and in 1900 it was found impossible to add to the number of the mines. The trouble in China, instead of promoting emigration seemed to draw the Chinese homeward, and some promising exploitations had to be closed for that reason. In the year just closed the labor supply was greater, and the results are shown in the larger output.

It is a curious fact that, with the exception of the comparatively small outputs of Cornwall and Bolivia, the world's supply of tin is mined almost entirely by Chinese labor, which is employed in the Banka and Billiton mines, as well as in the Malay Peninsula, and is even important in Australia.

The table given above does not entirely cover the tin production of the world, though it gives that portion which enters into commerce. Small quantities are produced in Mexico, which are used locally. In China there is a considerable output, the amount of which cannot be estimated with any approach to accuracy. Prof. Louis believed that it exceeded 10,000 tons yearly and might possibly be as high as 20,000 tons, but he admitted the difficulty of forming any definite idea. It is all consumed in the country. Japan produces a small quantity, which is used in making brass.

There are rumors of the discovery of alluvial tin deposits in the Philippines, but so far no examinations of a reliable character have been made. In view of the value of such deposits, if they exist, American prospectors and miners may be trusted to develop them when conditions become more settled in our new possessions.

**THE TIN MARKET IN 1901.**

This metal, so often a source of bewilderment to producers and consumers alike, again made good its reputation as the most speculative article on the list, concerning which statistics go for naught when either the buying fever is rampant or outside causes depress the holders. To a large degree also the market emancipated itself from the influence of silver.

Consumption throughout the year was heavy, with only short interruptions on this side of the Atlantic especially, our market very often moving entirely independent of that in London. Futures could at nearly all times be bought at a discount. On the other hand, the scarcity of labor caused by the Chinese war, which made itself felt last year to the detriment of the production in the far East, was followed by an abundant supply. Shipments from the Straits were consequently large; and the production of Banca tin also shows an increase, while that of Billiton and Australian has about held its own.

According to the Dutch budget for 1902, 250,000 piculs of Banca tin will again be offered in the usual six bi-monthly sales in Holland. This action may tend to reduce the reserve supply of this description.

The year opened rather dull, spot tin selling at about 26 1/2 cents, and consumers and speculators not taking much interest in the article. By the middle of March prices had declined to 25 1/2 cents. Business then became more brisk, and stimulated by speculative buying the market advanced to 28 1/2 cents, which was the closing quotation at the end of May. It kept steady through out the month of June at about that figure.

Somewhat later, the steamer *Asturia* with 750 tons of tin aboard foundered, and the London market was practically cornered, spot tin over there at one time selling at £140, and three months at £ 123 15s., a backwardation of nearly £17. A sharp decline abroad carried prices down also in this country, and during August spot tin could again be bought at 26 1/2 cents.

During September, the strike at the mills of the



United States Steel Corporation exercised a depressing influence on the market. In view of the heavy fluctuations in London and the large backwardation, manufacturers allowed their stocks to run down and confined their purchases to their immediate requirements.

With spot tin ruling at a premium of from one to two cents, quotations nevertheless steadily declined until 24½ cents was reached the beginning of November. About the middle of the month, the lethargy which had prevailed for such a long time gave way to considerable activity. The steel strike was at an end, consumption apparently very large,

Monthly Average Prices of Tin in New York. In cents, per pound.

	1900.	1901.
January	27.07	26.51
February	30.58	26.68
March	32.90	26.03
April	30.90	25.93
May	29.37	27.12
June	30.50	28.60
July	33.10	27.85
August	31.28	26.78
September	29.42	25.31
October	28.54	26.62
November	28.25	26.67
December	28.94	24.36
Year	29.90	26.54

and the available supply in sight quite small. This caused prices to advance by leaps and bounds, and during the last few days of November it developed that the market was cornered to all intents and purposes. Some belated bears had to pay 33 and 35 cents to cover their commitments.

These extraordinary conditions were soon followed by a sharp reaction. The East was selling freely at the high values which had been established; several overdue steamers arrived with large quantities of tin aboard, and in sympathy with the heavy decline in copper prices suddenly broke to 25 cents. About the middle of December, the failure of one of the most prominent operators on the London Metal Exchange was announced, and another heavy decline set in, spot tin selling at 23 cents. Consumers bought freely at this figure, and the year closes with spot tin selling at 23½ to 23¾ and futures at 23 to 23¼ cents.

**ALUMINUM IN 1901.**

But little can be said of the production of aluminum in the United States during the year 1901, as the one producer, the Pittsburg Reduction Company, has preserved its usual reticence as to the annual output. Considering, however, the extent to which aluminum is now being used as a conductor of electricity, and its consumption in the manufacture of domestic utensils, alloys, etc., it may be safely assumed that the production for 1901, is if anything, larger than for 1900.

In Canada the branch works of the Pittsburg Reduction Company at Shawanigan Falls, Quebec, were contemplated during the year at a cost of \$250,000. This plant is the first constructed in Canada, for the manufacture of aluminum, and the power to operate it will be generated at the Shawanigan Falls, three miles north of the town of Three Rivers. In addition to the advantage of available water power, the proximity of the corundum deposits renders the location an excellent one.

Toward the latter part of the year it was rumored that an agreement to regulate the price of aluminum and to prevent competition had been made between the Pittsburg Reduction Company, and the Neuhausen Company, of Switzerland, to be extended later to the companies in France. Definite information concerning this report is not at hand, although it is quite probable as the producers of aluminum are so few in number that the combination could be easily made. For the development of the industry, however, it would be far better to cheapen the metal and extend its use. In the end, the manufacturers would be more benefited than by any present arrangement to maintain the prices, which must necessarily limit the consumption.

*Aluminum vs. Copper Conductors.*—The continued high price of copper throughout the year has created a strong tendency to replace its use by aluminum as a measure of economy, and a considerable number of aluminum transmission lines have been erected, some on a very large scale, and while considerable progress has been made in the use of aluminum in the place of copper for power transmission, conducting purposes, electric lighting, street railways and for telephone and similar purposes, its durability has not yet been definitely established. Should the metal or alloy used prove satisfactory, it promises to become an important rival of copper in this field. In this connection, however, it is well to bear in mind the relative production of the two metals. In 1900 the total production of aluminum in the world was 5,570 metric tons, of which the United States furnished 2,053 tons, while that of copper was 492,625 metric tons, of which 272,536 tons were supplied by this country. That is, the total output of aluminum for 1900 was only 1.1 per cent that of copper. With reference to the copper market, it is not likely that the output of aluminum will seriously affect it until the relative production of the two metals is greatly changed in favor of aluminum.

The use of aluminum conductors for the transmission of power has been satisfactory when the metal has been pure, the presence of impurities having a marked effect upon its conductivity, its tensile strength and its durability. It is possible that many of the difficulties encountered in the use of aluminum wire for power transmission have been due to the impurity of the metal. From a corrosion point of view sodium is the worst element, followed by silicon, while for conductivity, the presence of iron even in very small amounts increases the resistance materially. Aluminum wire of 99 per cent aluminum has a conductivity of from 60 to 65, copper being 100, and a tensile strength of from 13 to 18 tons per square inch. Tests on aluminum wire made by J. B. C. Kershaw showed that in towns where sulphurous acid gas exists as an impurity of the atmosphere, the metal was badly corroded, while in country districts or in small towns where the impurities present in the atmosphere are reduced to a minimum, all metals seemed to be fairly durable.

*Special Uses.*—The Goldschmidt process of using the energy stored up in elemental aluminum for the reduction of refractory ores, while still in its infancy, is proving of considerable value and the Goldschmidt process for welding iron and steel is likewise being developed. So far these promising processes have not been applied commercially in this country.

The presence of iron in aluminum used for culinary vessels is very objectionable, as it becomes dissolved by contact with organic acids—citric, tartaric and acetic—particularly when salt which is present seems to intensify the corrosive action of the acids to a marked degree. The metal used for this purpose should therefore be of exceptional purity.

**QUICKSILVER IN 1901.**

Active development in the old quicksilver mines of California has been necessary in late years in order to keep the production up to requirements of the trade. This activity increased in 1901 and many new prospects were also exploited to the same end. Development work was most active in San Luis, Obispo County, but was carried on also in Sonoma, Solano, San Benito, Shasta, Mendocino, Santa Clara and Trinity counties, with the effect of increasing the total producing capacity of the State.

In Oregon the effort was made to increase the output from Lane and Douglas counties. In the former the Black Butte Mine is being extensively developed and ore reserves are being blocked out, and over 6,000 feet of underground development has been finished. The Elkhead Mine in Douglas County has been similarly developed on a smaller scale. Ore-

gon's production has been practically experimental in previous years.

The year has furnished a substantial increment to the supply from Texas, where the Terlingua District has been developed to supply 3,000 flasks a year, with a probably much larger capacity in the near future. The developments most needed were modern furnaces to handle the ores accumulated by the prospecting and exploitation of a host of claims. The Marfa & Mariposa Company has a 10-ton Scott & Huttner furnace in operation. Another larger furnace is being built for the Terlingua Mining Company; and the acquisition of outside claims by this and other large concerns indicates significant activity for the district.

*Prices.*—In contrast to the course of 1900, when quicksilver averaged higher in price than in any year since 1890, prices declined slightly, the average for the year being \$47 per flask for local delivery and \$42 for export.

These quotations are for the metal at San Francisco. One-third of the product was exported. The range in prices as follows:

	Per Flask.
January	\$48.00 to \$48.50
February	47.50 to 48.00
March	47.00 to 47.50
April	46.50 to 47.00
May	46.50 to 47.00
June	46.00 to 47.00
July	46.00 to 47.00
August	47.00 to 48.00
September	47.00 to 48.00
October	47.00 to 48.00
December	46.50 to 48.00

**NICKEL AND COBALT.**

*Prices.*—Stimulated by a high price, the demand for nickel was active during 1901. The price was steady during the whole year, the range from 50 to 60 cents per ton depending simply on the size of the order. It was difficult late in the year to obtain nickel, even in 5-ton lots at the lower price quoted. Under the stimulus of favorable prices, the progress of nickel mining has been of the most gratifying character in the principal source of supply, Sudbury, Ontario. At the close of the year the producing capacity of the district is about double that of two years ago, with the prospect of the control of the only considerable competitor, New Caledonia passing into the same hands.

*New Localities.*—Prospecting has been unusually active in the Sudbury District and also in many widely separated localities in the United States. Investigations of the nickel and cobalt arsenides at Lovelock's Station, Nevada, have been renewed, and an entirely different occurrence of nickel has been noted in the same State in the southeast, near Bunkerville, where the conditions resemble Sudbury. A third occurrence in Nevada has been found near Candelaria. A new alloy of iron and nickel, similar to the mineral Josephinite, has come to light near Gasquet, Del Norte County, California. Nickel ore is also being investigated in Pima County, Arizona, and another find is located on Piney Creek, in northern Wyoming. Meanwhile a rich cobalt ore has been developed in eastern Oregon.

*Uses.*—A significant extension of the industry of sufficient importance to take care of any new sources of supply is promised in the new Edison nickel storage battery.

**PLATINUM.**

The principal feature of interest in the platinum industry in 1901 has been the discovery of platinum-bearing ores "in place" partly due to persistent search in the regions which have long furnished placer sand, and partly to accidental discovery—especially that described quite fully in last week's issue of the ENGINEERING AND MINING JOURNAL, to the effect that platinum has been found in the Grand Encampment District in Wyoming, where there was no especial reason to suspect this metal. In addition to this, Prof. J. F. Kemp has found platinum in peridotite in Similkameen District, British Columbia;

Mr. A. W. Johnston has found traces of platinum in Serpentine, near Weaverville, Trinity County, California; David T. Day has found it in similar rocks near Junction City, in the same county; Mr. F. S. Osgood has found three localities showing platinum in place, all near Kirby, Josephine County, Oregon. Rocks containing platinum have been submitted to the U. S. Geological Survey from western Washington and Chalcopyrite containing platinum, and nickel has been reported in southeastern Nevada, near Bunkerville.

Much more effort has been made to encourage saving platinum in placer gold mining in California, and the development of an inexpensive form of apparatus known as the "Butler Board" for separating platinum from other heavy minerals have led to a greater product in 1901 than in any previous year, but the total remains small in spite of increasing demand.

Prices have ranged from \$18 to \$22 per ounce for the pure platinum contents of platinum sands. The imports into the United States show a decrease of about 15 per cent.

*Uses.*—The platinum industry will be greatly benefited in the coming year by the discovery of use for the element osmium, which occurs to a considerable extent in American platinum in the mineral osmiridium. Heretofore this element has interfered most seriously with the sale of crude platinum. But recently the demand for osmium for the new Auer incandescent electric light makes it as actively sought as platinum. Osmiridium is worth from \$6 to \$10 per ounce.

Quotations for platinum per troy ounce in New York stood at \$18.20 from the opening of the year up to May 11. At that date the price was advanced to \$20.50 and remained there until the close of September. During October, November and December the price was \$20 to \$21 per ounce, New York.

#### THE NEW YORK ANTIMONY MARKET IN 1901.

Business in this article during 1901 has been rather dull, and the market has had a drooping tendency. The year opened with Cookson's selling at 10 cents; Hallett's, 9 cents; Hungarian, Italian and U. S. Star, at 8¾ cents. Prices declined slowly throughout the year, and the closing quotations are given as 10 cents for Cookson's; 8@8¾ cents for Hallett's; 7¾@8 cents for Italian, Hungarian, Japanese and U. S. Star. These figures are understood for retail lots; larger quantities can be secured at a concession.

Consumption, although satisfactory, does not show any change from last year. Imports of ore and the United States production show a falling off, while imports of metal or regulus increased. There has been a tendency to substitute some of the new and cheaper brands for the standard English brands. Stocks at the end of the year are comparatively small.

#### CHROME ORE IN NEW CALEDONIA.

A correspondent in Noumea, New Caledonia, writes us that he controls a large deposit of chrome ore assaying up to 56 per cent sesquioxide of chromium, and desires to open commercial relations with firms in the United States. The mines under his charge are considered the richest in that colony, which has a number of deposits of chrome ore. He states that the ore can be delivered alongside in bulk at a price equivalent to \$12.50 per ton for 50-per cent ore, with an increase of 60 cents per unit for each unit up to 56 per cent. Lower grades can be delivered alongside ship at prices ranging from \$8.40 for 46-per cent ore up to \$11.50 for ore between 49 and 50 per cent. The freight charges from Noumea to New York or Philadelphia would be about \$3.30 per ton. We should be pleased to forward to our correspondent addresses of any parties desiring to buy chrome ore.

#### COAL IN 1901.

By EDWARD W. PARKER.

Advices from all of the important coal producing centers show that the phenomenally large production which this country attained in 1900 has been exceeded in 1901 by about 30,000,000 tons, which will bring the product last year up to approximately 300,000,000 short tons. Even this enormous figure would have been exceeded had it been within the power of the transportation companies to handle the product to the markets. During the most of the year and particularly during the latter half the scarcity of car supply was a constant complaint from the coal shippers, and this condition became so emphasized in December that a coal famine was imminent in a number of eastern cities. The previous short supply had been rendered more acute by heavy floods, which not only interfered with the transportation companies, but caused the cessation of operations at a number of collieries in the anthracite region of Pennsylvania. So inadequate were the railroad facilities to respond to the demands placed upon them in the last two weeks of December, that coal was at a premium in the city of Pittsburgh, a condition unprecedented in our industrial history. The demand for iron and steel and the manufactures thereof is so great at the time of writing this report that the usual shutting down of furnaces for the holiday season was passed, and this, added to the increased demand for coal incident to the winter season, has produced a shortage of fuel at all points. Even the usual release of cars previously employed in the transportation of iron ores during the open season from the Lake ports to the furnaces in Ohio and the Pittsburgh District has been unable to relieve the situation. The shortage of car supply was not limited, however, to the eastern fields. The same condition existed throughout the West and South and was the most striking feature of the industry during the year.

In reviewing the coal mining industry as a whole, one change that has taken place in the last few years is worthy of special notice. This has been the practical elimination of anthracite coal as a factor in manufacturing enterprises. We can not, of course, consider in this statement the comparatively unimportant establishments in a few large eastern cities such as New York, Boston, Philadelphia, etc., where, as in large buildings, power is furnished with the premises and is obtained from steam raised from hard coal. As a blast-furnace fuel and in establishments where large quantities of coal are consumed anthracite coal has given way to its bituminous rival or to the produce of bituminous coal—coke. Anthracite coal has now become almost entirely a domestic fuel, and apart from the irregularities in production produced by strikes or other disturbing influences the annual fluctuations of the trade may be said to follow the readings of the thermometer with the natural increase of consumption due to increased population and the uncertain elements of prosperity and hard times. In some localities anthracite coal is a luxury and used only in periods of exceptional prosperity such as is recorded by the past twelve months.

In the following table is presented a statement amounted to 28,649,811 short tons. In 1900, the production had about doubled, aggregating 57,367,915 short tons. The production of bituminous coal in 1900 was almost exactly five times the output in 1880, as shown by a product in the two years, respectively, of 42,831,758 and 212,513,912 short tons. Taking the statistics of coal production in connection with that of the population of the United States, as reported at the Tenth, Eleventh and Twelfth censuses, we find that the per capita consumption of anthracite coal in 1880 was 0.58 short ton. In 1890 the per capita consumption had increased to 0.75 ton, but no further increase was shown by the statistics for 1900, the rate being the same as in 1890. In the bituminous

trade, on the other hand, we find that the per capita consumption increased from 0.85 ton in 1880 to 1.78 tons in 1890 and to 2.78 tons in 1900.

In the following table is presented a statement of the production of anthracite and bituminous coal in 1880, and the average annual production by five-year periods during the last two decades of the nineteenth century. It will be observed that the average annual production of anthracite in the five years 1896-1900 was about 4 per cent larger than in the preceding five years, while the increase in bituminous production was about 37 per cent, a rate which was practically maintained during the 20 years.

Production of Anthracite and Bituminous Coal in the United States, 1880 to 1900 by Five-Year Averages.

	Anthracite. Short Tons.	Bituminous. Short Tons.
1880.....	28,649,811	42,831,758
1881-85.....	36,194,188	70,816,115
1886-90.....	42,151,364	94,488,681
1891-95.....	53,405,189	125,216,327
1896-1900.....	55,625,165	171,535,637

The production of anthracite coal in 1901 will exceed that of 1900 by probably 8,000,000 tons, and will exceed the year of previous maximum production (1899) by about 5,000,000 tons. The exceptional prosperity which prevailed throughout the entire country during 1901, and the fact that the producing regions were free from labor disturbances of any note expanded the production to an unusual degree. A large amount of anthracite coal was shipped to the West and Northwest last year and consumed in regions where it is classed among the luxuries and only allowable in years of plenty.

The record of bituminous coal production is one which reflects with considerable accuracy the record of our industrial development. The census figures show that from 1880 to 1900 the population of the United States increased approximately 50 per cent. The production of anthracite coal increased 100 per cent. At the same rate of increase as that of the population the production of bituminous coal in 1900 would have been about 64,500,000 short tons. At the rate of increase shown by anthracite production it would have been about 86,000,000 short tons. The actual production was 212,513,912 short tons, an increase of 396 per cent. Conservative estimates based upon reports from reliable sources place the production of bituminous coal last year at 235,000,000 tons, or about 10 per cent in excess of that of 1900. This increased production has been distributed throughout all the coal producing regions, and the product has been almost entirely used for home consumption. The attempts to build up a heavy export trade in soft coal (the wisdom of which is, to say the least, questionable) has not been particularly successful, the principal cause for such failure being the extraordinary home demand. When the time comes, if it ever does, that we shall be exporting large quantities of coal or other raw materials we shall have entered upon a time of comparative industrial retrogression.

The year 1899 was the first one in twelve in which the price of bituminous coal recorded an advance over the preceding one. A further advance was made in 1900, the average price for bituminous coal in that year being \$1.04 per short ton, the highest obtained since 1887. Throughout 1901 prices were generally higher even than in 1900, labor was better paid than for many years and the industry as a whole was in a most satisfactory condition, the only cause for complaint being the shortness of car supply and the lamentable inability of the railroads to handle the business offered them.

Pennsylvania continues to hold undisputed supremacy as a coal producer, her combined product of hard and soft coal amounting to more than half the total product of the United States. The bituminous product of Pennsylvania in 1900 was 79,842,326 short tons, something more than one-third the total bituminous output that year. Penn-



sylvania's bituminous production for 1901 will be between 85,000,000 and 90,000,000 tons.

Maryland's coal-mining industry in 1900 was injured by labor strikes and the production fell off nearly 800,000 short tons from the second year of 1899. The production for 1901 will probably equal if not exceed that of 1899 and will reach the neighborhood of 5,000,000 tons.

Virginia and West Virginia, combined, in 1900 produced a little over 25,000,000 short tons, of which something over 90 per cent is credited to the latter State. It is estimated that these two States have contributed about 30,000,000 tons to the product of 1901. West Virginia is now the third in rank among the coal-producing States, but is destined to displace Illinois, which now ranks next to Pennsylvania.

Returns from the Birmingham District indicate that Alabama's production last year will reach the 9,000,000 ton mark. The State's production in 1900 was 8,394,275 short tons. Some of the market for Alabama coal in Mobile, New Orleans and other Gulf points has been taken away by the use of fuel oil, but this loss has been more than made up by the increased demand from iron furnaces and other industries. Tennessee will show a production in 1901 of over 4,000,000 tons for the first time in her history. The annual production has increased steadily since 1893.

In the central coal field, in which is embraced the producing areas of Illinois, Indiana and Western Kentucky, the same activity was experienced as in the eastern States and there were no serious losses by reason of strikes. This region produced in 1900, 35,358,164 short tons, which will be increased to about 38,000,000 tons for 1901.

Continued activity has been shown in the northern fields of Michigan, the industrial developments along the Great Lakes having produced a profitable market for this coal.

Reports from the western coal-producing regions show a condition similar to that prevailing among the eastern and central States. In the territory covered by the States of Iowa, Kansas, Arkansas, Missouri, Texas, and the Indian Territory a comparison of the business of 1901 with the preceding year will bring out prominently the following general results; (1) The largest annual production of coal in the history of the region. (2) An increase of fully 20 per cent over the production in 1900. (3) An average market demand for coal of from 10 to 15 per cent in excess of actual production, which was restricted by the greatest shortage of traffic facilities both in railroad cars and motive power throughout the year, ever known to the trade. (4) In the Texas market a decrease of probably 5 per cent in coal consumption, due to the substitution of oil for fuel, which will, however, be more than compensated for by the increase in volume of coal tonnage in this market as compared with any previous year. (5) A year unusually free from general strikes and labor disturbances. (6) The highest rates ever paid for mining and other labor wages, as well as a uniform advanced realization in the selling price of coal.

The State of Missouri has responded to the increased demand for fuel throughout the Trans-Missouri country, and the development of new mines is noticeable in most of the coal fields of the State. This is particularly true in northern Missouri. Some of the larger companies operating in Macon County and that region have largely increased their holdings of coal land, and by constructing tap lines to the principal railroads traversing that field, have brought into the market much additional coal. An impetus to coal mining has also taken place along the Omaha, Kansas City and Eastern Railroad, in Adair County. Much of this activity is due to the decreasing product in the Rich Hill field, in Bates County, which district until recently headed the list of coal producing counties in the State. The exhaustion of the limited area has encouraged development in other directions. The total coal product of Missouri in 1900, of 3,540,103 tons, as reported by the United

States Geological Survey promises to be exceeded by 500,000 tons in 1901.

Kansas, which in 1900 produced 4,467,870 tons, will probably record a product for 1901 of 5,500,000 tons.

The Cherokee and Crawford County fields still maintain their importance in the coal product of this State, and about all of the proven coal area lying therein has been purchased by the present operating companies, hundreds of thousands of dollars having been expended during the past year by the larger interests in adding to their acreage, and land values have naturally increased thereby. The general prosperity and renewed activity in manufacturing lines, together with the large increase in consumption by the railroad companies for locomotive use, has occasioned an unusual demand in this section, as elsewhere.

The coal product of Arkansas has attracted unusual attention during the past year, owing to the popularity of the smokeless coal which abounds in that State. The demand of the public in large cities for the suppression of smoke has induced capital to develop the smokeless coal of Arkansas, which finds a ready sale in the larger markets. These coals, popularly known as Jenny Lind, Denning, Bonanza and Huntington, have become a permanent factor at Kansas City, Mo., and are in strong demand as far north as Omaha. Even St. Louis, with its abundant supply of cheap Illinois coal, affords a prominent market for the Arkansas mines, in response to the demand of the people for relief from the smoke, which has become oppressive. This has resulted in the promotion of St. Louis mining companies for the development of the smokeless coal of Arkansas. There is doubt, however, of their ability to successfully compete for the steam trade of the World's Fair City. Many rumors are current connecting the names of J. Pierpont Morgan and John W. Gates with mammoth enterprises for the purpose above stated, and the citizens of Arkansas are much agitated in consequence. However, this may be, there is unquestionably opportunity for legitimate business enterprises in the coal industry of Arkansas. The tonnage of Arkansas recorded for 1900 was 1,447,945 tons. It is conservatively estimated that this will be increased for the year 1901 from 50 to 75 per cent.

Probably no other section has experienced greater activity in coal mining than the Indian Territory. The enactment of the Curtis Act in 1898, whereby the Government assumed control of the leases, eliminating individual leases has invited capital to enter that field freely. The excellent quality of the coal available has enabled the mining companies to extend their operations. Much of the increased product has found a market in Oklahoma and other sections that are settling rapidly further west.

The Beaumont oil discovery threatens to check the coal industry of the Indian Territory and Arkansas. By far the greatest portion of the product of these fields is marketed within the State of Texas. The introduction of oil as fuel will displace a large coal tonnage heretofore shipped from these mines. Should the railroad companies of Texas adopt oil as a fuel, the situation may indeed be a serious one for the coal mines of the Indian Territory, although the natural increase in the consumption in other directions will modify the effect of the oil competition to a great extent.

The coal product of the Indian Territory, which for the years 1900, recorded as 1,922,298 tons, is now believed will for 1901 exceed 3,000,000 tons.

Iowa which is the largest coal-producing State west of the Mississippi River with the exception of Colorado, was also a region of increased activity during 1901, and the production for last year will show a total of about 5,750,000 tons, or a gain of about 10 per cent over the preceding year. Iowa differs somewhat from the other western coal-producing States in that her production is made up largely from comparatively moderately sized establishments; that is those producing from 30,000 to 50,000 tons annually. There are only a

few companies in the State whose product reaches as much as 100,000 tons a year. The principal coal-producing counties are Mahaska, Polk, Monroe, and Appanoose in the order named.

Among the Rocky Mountain States Colorado holds first place, with Wyoming second. The other coal-producing States included in this region are Montana, Utah, North Dakota and the Territory of New Mexico. The production of this region for 1901 will reach approximately 15,000,000 or about 1,600,000 tons over that of 1900.

It is not possible at this time to state what effect the increased use of petroleum for fuel in California has had upon the coal mining industry of the Pacific Coast. Washington is the only important coal-producing State. The production for the region will probably not exceed that of 1900.

#### MECHANICAL PRODUCTION OF BITUMINOUS COAL IN THE UNITED STATES

The progress made in the last few years in the development of the use of undercutting machines for the mining of bituminous coal in the United States has attracted more attention than any other single feature in connection with the coal-mining industry. The statistics for 1900 as compiled by the United States Geological Survey, show that about one-fourth of the total amount of bituminous coal mined in this country was undercut by the use of machines. The total production of bituminous coal in the United States showed an increase in 1900 over 1899 of 18,263,674 short tons, or less than 10 per cent. The machine-mined product increased from 43,963,933 short tons to 52,790,523 short tons, a gain of 8,826,590 short tons, or something over 20 per cent. Nearly 50 per cent of the total increase in the output of bituminous coal in 1900 was contributed by mines operating machines.

Machines were used in 22 States and Territories in 1900, the same number as in 1899. The statistics of the use of mining machines in Illinois were obtained from the report of the State Bureau of Labor Statistics. They show that while there was an increase of six in the number of firms using machines in the State, there was a decrease of ten in the number of machines in use and of over 1,000,000 tons in the machine-mined product. The opposition of the labor unions to the use of machines in Illinois is responsible for this decrease. With the exception of Illinois, the statistics were compiled from the reports of the operators to the Geological Survey. There were 323 firms or corporations in the United States using mining machines in 1900 as against 308 in 1899; 280 in 1898, and 208 in 1897. The numbers of machines actually in use in each year were 1,956 in 1897, 2,622 in 1898, 3,125 in 1899, and 3,907 in 1900. The total amount of coal mined by machines in 1900 was 52,790,523 short tons, as compared with 43,963,933 short tons in 1899 and 32,413,144 short tons in 1898.

#### IMPORTS AND EXPORTS.

The latest statistics available regarding the imports and exports of coal during 1901 are for the eleven months ending November 30. Both show a decline although the decrease in imports was hardly noticeable. Our imports are principally obtained from British Columbia and Australia to San Francisco and other California ports, and from Nova Scotia to New England ports, particularly Boston. The principal export trade is via the international bridges to Canada.

For the eleven months ending with November the amount of coal imported into the United States was 1,745,636 long tons, valued at \$4,810,164, as compared with 1,757,561 long tons, valued at \$4,614,463 for the same period in 1900, and 1,229,124 tons, valued at \$3,451,546 in 1899. The total imports for 1900 amounted to 1,881,519 long tons. The imports for November, 1901, were 173,788 long tons, as compared with 226,252 long tons in 1900. Practically all of the decrease in 1901 was made in October and November. The record for these two months in 1901 was nearly 110,000 tons below that of the preceding year.

The exports of coal for the first eleven months of 1901 show a falling off of a little over 200,000 long tons. The exports of anthracite increased about 400,000 tons while bituminous exports decreased 600,000 tons. Exports for the eleven months ending November in the last three years have been as follows in long tons:

	1899.	1900.	1901.
Anthracite .....	1,564,138	1,495,327	1,889,438
Bituminous .....	3,644,679	5,649,712	5,043,221
Total .....	5,208,817	7,145,039	6,932,659

#### THE ANTHRACITE COAL TRADE IN 1901.

The year just closed will always be memorable in the history of the anthracite coal trade. Not only was the production the largest on record, exceeding that of 1900 by over 8,000,000 tons, but the prices secured have been thoroughly satisfactory to producers. This combination of large output and higher prices is a decided novelty. The record-breaking output of 1895 was accompanied by a fierce competition for tonnage among the different producers, and the total result of the year's operations was not financially satisfying. The present condition of the anthracite trade is so utterly different from its status a few years ago, that a brief review of the conditions controlling mining and transportation is in place.

The anthracite fields of Pennsylvania embrace an area of about 440 square miles. Their situation, as the only large source of fuel supply near the manufacturing cities of the Atlantic seaboard, stimulated their development. In the early days coal could be easily mined, and coal lands were cheap, a great number of small mines were opened, and the consequent production swamped the available market. The fierce competition which resulted led to various attempts to restrict output, while the stronger companies gradually forced out the smaller and more poorly equipped mines. The Civil War and a great demand for fuel stimulated the opening of new mines and the building of new railroads, and this movement was further stimulated by the period of wild speculation and promiscuous railroad building that preceded the crash of 1873. The attempt to bring order out of chaos in the next few years resulted in little good. The production available was in excess of market needs, while the mines had to keep busy and the railroads had to haul the coal to keep solvent. Then followed the attempt of Mr. Franklin B. Gowen, president of the Philadelphia & Reading Railroad, to control the output and insure a firmer market by taking over the mines and undeveloped mining lands along the branches of the road. This policy was imitated by the Lehigh Valley, the New Jersey Central and the Delaware, Lackawanna & Western railroads. It was thought that as the available amount of anthracite was limited, while consumption was likely to increase steadily, that such control of coal lands would be extremely profitable in the end. Attempts to control output and increase prices, however, by agreements among the principal roads, simply led to the construction of other lines, more competition, and no increase in profits. It was found also that the managers of the various companies could not trust each other and, year after year, agreements to restrict production to certain limits or to sell at certain prices were made, only to be violated. The ambition of each road was usually to make as big an output as possible, thus decreasing the cost per ton for mining and increasing the profit expected from the rail haul, though the inevitable result was a selling price that left little profit in mining. The railroads were burdened with coal properties, taken under leases at high royalties, with large minimum outputs, and the fixed charges on production increased as the mines went deeper.

All chances for intelligent control of production and transportation seemed over in 1898, when the industry was in unusually poor shape. It was apparent that between open dishonesty, gross incompetency and visionary attempts to defy the ordinary laws of supply and demand, the anthracite trade had been woefully mismanaged.

Yet that same year the man to lead the anthracite

industry out of its aimless wanderings came forward in Mr. J. P. Morgan. Realizing that firm control could not be secured by agreements, but only by actual ownership, he and certain financiers associated with him, began to buy stock. Thus they gradually secured control of the Philadelphia & Reading, then of the Jersey Central, and early in 1901 of the Lehigh Valley. In 1900, by agreements with the Delaware & Hudson Company, they controlled that company's tidewater shipments over the Erie. At the opening of 1901, Morgan interests were thus in control of 63 per cent of the total tonnage annually shipped out of the anthracite region, enabling them to put into effect and maintain by strength of position whatever plans they wished. This "community of interests," so-called, had for its working head the Temple Iron Company, a company organized with very liberal charter provisions in 1899. The directors of this company include presidents of all the coal-carrying roads under Morgan control. The company is thus not a trust in the usual acceptance of that term, and cannot be easily reached by any State or United States statutes governing illegal competition or restriction of output. Its directors can discuss policies quietly, there are no necessities for agreements, and harmony is absolute.

In its issue of January 12, the ENGINEERING AND MINING JOURNAL said: "The present control of the market indicates regulation of output to market needs, the end of cut-throat competition, and quite possibly slightly higher average prices." The developments of the year bore out this prediction.

The total shipments from the mines in 1901 were 53,386,271 long tons compared with 45,107,484 tons in 1900 and 47,665,203 tons in 1899. The 1895 shipments were 46,511,477 tons. Shipments by months were as follows, December, 1901, being estimated:

	1899.	1900.	1901.
January .....	3,761,768	4,482,641	5,183,392
February .....	2,810,450	3,188,180	4,098,968
March .....	3,416,711	3,133,896	4,964,359
April .....	3,078,088	3,364,482	3,685,013
May .....	3,557,693	3,833,097	4,674,707
June .....	4,073,364	4,676,580	4,755,748
July .....	4,189,250	3,599,729	3,698,814
August .....	4,319,031	4,951,166	4,710,517
September .....	4,502,880	2,072,948	4,379,157
October .....	4,899,303	834,786	4,938,132
November .....	4,688,859	4,994,799	4,697,443
December .....	4,502,832	5,075,189	3,600,000
Total .....	47,665,203	45,107,484	53,386,271

The shipments of January, February, March, April, May and September, 1901, August and December, 1900, and July, 1899, were the largest on record.

*Trade by Months.*—The opening of 1901 found anthracite in demand. The market had not recovered from the effect of the miners' strike during September and part of October, though the mines in December had shipped something like 5,000,000 tons of coal. Though the weather was mild, activity in the East was greater than for 30 years, while Western trade was also good. The regular prices quoted for free-burning white ash coal, f. o. b. New York, were broken \$4, egg \$4.25, stove and nut \$4.50, pea \$3.

The weather continued mild throughout January. Demand held up well with the steam sizes and stove and chestnut bringing full circular prices and at some points a premium of 25 cents per ton for prompt delivery, though there was a slight decline in prices for broken and egg. February opened with cold weather and high winds, and the consumption of coal increased. Prices were firm at \$3.65 for broken, \$4 for egg, and \$4.50 for stove and chestnut. The month was unusually cold and stormy. March likewise was a month of low temperature and high winds and the consumption of fuel for domestic purposes was very heavy. Prices showed no change. All the coal that the mines could bring forward was taken, and by the opening of April supplies everywhere were unusually low. At the head of Lake Superior, docks were bare. Consumers in Chicago territory were taking unusually large all-rail shipments, and dock supplies were unusually low. At inland points east the market was firm and every condition was favorable for an unusually good spring trade, and for any new plan of regulating output that might be tried. The various mining and transportation companies

issued a spring price list on April 1. This price list differed materially from any issued before. It named certain prices for the prepared sizes and offered discounts for prompt buying. Thus the New York Harbor f. o. b. prices for free-burning white ash coal, f. o. b. were broken \$4, egg \$4.25, nut and stove \$4.50. The steam sizes—pea, buckwheat and rice—were not included, but were to be sold at the discretion of the various companies. The discount offered from the list prices were of 50 cents per ton for April, 40 cents for May, and so on, till full list prices were in force again, September 1. Another novelty was that sales for forward delivery were abolished. Coal shipped in April received April discounts, but no orders at April discounts were to be taken for May delivery. This chance was of particular importance to the Western trade. In addition, discounts to middlemen and jobbers were largely abolished, and prices were made the same to all dealers.

It was realized, particularly by the Western trade, that back of the list was the power to enforce it. So the price list received respectful attention and brought out considerable early buying by the prudent. Fears of a general strike of the miners on a May 1 to secure recognition of their union had doubtless lead to considerable buying during March, beyond that due to the weather. The danger of a strike was removed, however, when the Reading and other companies posted notices about March 12 that the 10 per cent advance in wages granted after the strike of 1900 would remain in force a year longer.

Trade during April was generally better, particularly at eastern points, than had usually been the case in previous years. In the West trade was generally quiet, while in Lake Superior territory anthracite dealers were out of the market. May began with the demand in the East still good and prices ten cents a ton higher, as per schedule, that is \$3.60 for broken, \$3.85 for egg, and \$4.10 for stove and chestnut, f. o. b. New York Harbor shipping port. Navigation on the lakes was late in opening and a strike of the lake engineers delayed the movement and a strike of the lake engineers delayed the movement of coal from Buffalo. Buying during the month in the East was liberal, some firms not being able to secure all the coal they wanted at May prices. The movement of coal up the lakes toward the end of the month was heavy. In the East receipts at Boston for the month were 55 per cent greater than in 1900. At the end of May the collieries were working one-half to two-thirds of full time. Supplies in the hands of producers were less on May 31 than on May 1; a most remarkable showing.

With warmer weather in June, the market continued surprisingly strong at Eastern points. Buyers in the West apparently did not understand the situation as well as those in the East, though the demand at Chicago, from wholesalers was quite active, a most remarkable occurrence. The movement of coal up the lakes continued good and demand in the East showed little falling off.

The total shipments from the mines to June 30th amounted to 27,362,187 tons compared with 22,678,400 tons in 1900, showing the first half year to have been the most active in the history of the anthracite trade.

In previous years, a period of stagnation, known as "midsummer dullness" had usually settled on the coal trade about June 1, lasting until September 1, or even later. In 1901, however, there was no midsummer dullness whatever. Consumers in the East, realized that they could not hope to secure coal at bargain prices by waiting until September and seeing the producing companies break agreements and sell coal regardless of profits.

A strike of mine firemen affected production in the Wyoming and Lackawanna fields during the latter part of July. Demand at both eastern and western points continued remarkably good for the season, and by the end of the month stocks in producers' hands were less than at the beginning. The market during August was generally quiet but strong.

With prices back to full list figures in September, and the market good, doubters of the stability of the new order of things were utterly routed. The most



critical period in the yearly course of the trade was safely past and the most conservative buyers were forced to admit that times had changed. Buying for western account continued active during September. There were some reports of coal selling for less than list prices, but these reports applied to special grades or conditions and did not affect the market as a whole. By the opening of October most of the collieries were running very nearly full time, with demand good at all points and virtually the only restriction on output was a shortage of cars. This shortage soon became marked and lasted for the rest of the year.

It did not trouble anthracite as much as bituminous producers, but affected shipments to all points. It was due, as noted in a previous article, to general conditions. Renewed industrial activity and the annual movement of farm products found railroads all over the country short of both cars and locomotives to meet the enormous demands of producers.

During the balance of the year, the production was controlled largely by the car supply. By the end of November the Reading collieries and those of some other companies were mining on short time. Demand was strong at both eastern and western points. A heavy rain storm in the anthracite region in December did much damage and decreased the December shipments over 500,000 tons. It caused a suspension of shipments on the Lehigh Valley, Central Railroad of New Jersey, and Philadelphia & Reading for nearly two weeks. The year closed with the market very strong and little coal in the hands of producers.

From this brief summary it can be seen that the extremely favorable showing of the anthracite trade in 1901 was due to three causes. First, an absolute control of production and transportation by the "community of interest" plan, perfected in the Temple Iron Company and by understandings with the chief holders of stock in the Delaware & Hudson, and Delaware, Lackawanna & Western Companies; second, the general prosperity of the country; third, the cold weather and high winds in February, March and April, which caused a heavy consumption of coal for domestic purposes, so that stocks at many inland points, and particularly in the West, were completely gone when warm weather came. The last two causes affected production, the first, prices.

The average prices of the prepared sizes of free burning white ash coal for the past 3 years f. o. b. New York Harbor shipping ports compare as follows:

Sizes and Months.	1899.	1900.	1901.
Broken:			
January-June .....	\$3.13	\$3.14	\$3.58
July-December .....	3.22	3.33	3.94
Eggs:			
January-June .....	3.27	3.37	3.95
July-December .....	3.49	3.57	4.19
Stoves:			
January-June .....	3.59	3.72	4.26
July-December .....	3.92	4.07	4.47
Nuts:			
January-June .....	3.53	3.73	4.29
July-December .....	3.93	4.08	4.47

The outlook for 1902 is bright. The "community of interests" plan has proved triumphant in controlling production and prices during a good year. What it can do in a poor year remains to be seen. Everything favors a good demand for 1902. Some labor troubles are anticipated when the United Mine Workers present demands for recognition of the union and for uniform wage scales, as they probably will before the present agreement expires next April. It seems probable, however, that there will be no open rupture between employers and miners. The same sagacity that has succeeded in preventing wasteful competition should find a means of adjusting labor difficulties without needless loss.

**Export Trade.**—The great bulk of the anthracite coal exported from the United States goes by rail or canal to Canada. There are also small shipments to Mexico and the West Indies. Several attempts have been made from time to time to build up a market in Europe. The most noteworthy was that of Mr. Franklin B. Gowen, when president of the Reading Railroad, but his efforts amounted to nothing. A somewhat better advertised and more spectacular at-

tempt was that of a representative of the Anthracite Operators' Association a few years ago, but again no sales resulted. Anthracite coal is on the continent a luxury for the rich, and the stoves used by the great majority of the people are not suited for it.

The first exports of any importance from the United States to Europe were made last October. They were due to an unusually low ocean freight rate and also very possibly to a desire of the foreign buyers to get better terms from the Welsh anthracite operators. A number of orders were placed for lots of from 3,000 to 10,000 tons, and the movement might have assumed very respectable figures, but for the great demand that started on this side. It is reported that the Reading Company was offered a contract for 100,000 tons for export to France, and refused it, having at the time no coal in storage at tide water and not caring to take such a large contract when the home market was so strong.

It is not to be expected that anthracite from American mines will ever cut much figure in our exports to Europe. Low ocean freights and high prices for English anthracite are the only conditions under which such shipments are possible.

### THE ATLANTIC SEABOARD BITUMINOUS TRADE.

Except for the coal shipped to Boston and a few other points beyond Cape Cod, from the mines in Nova Scotia, and a limited amount of Georgia, Kentucky and Tennessee coal that reaches Charleston and Savannah, the soft coal consumed along the Atlantic seaboard comes from Pennsylvania, Maryland, Virginia and West Virginia. The coal is shipped to tide water from the mines over four railroads, the Norfolk & Western, which carries the product of the Pocahontas and Flat Top fields in Southwest Virginia and Southeast West Virginia, to Norfolk; the Chesapeake & Ohio, from the New River fields to Newport News, the Baltimore & Ohio from the Piedmont and Cumberland districts in West Virginia and Maryland to Baltimore, and the Pennsylvania system, which carries to Philadelphia the coal from the Clearfield and the Huntington and Broadtop fields in Pennsylvania, and the Cumberland Region in Maryland. These roads, as was noted in our review last year, are now practically under one control, stockholders in the Pennsylvania Railroad Company having a controlling interest in the three other lines.

The domestic markets supplied by the mining fields mentioned, are usually for convenience divided into four districts; the all-rail, covering the territory between the mines and the seaboard, and also certain cities in Eastern New York, Vermont and Western Massachusetts; the New York Harbor, which includes all consumers around New York Harbor and on the lower Hudson; Long Island Sound, including the ports on Long Island Sound, Narragansett and Buzzard's Bay, from which are supplied the manufacturing towns of Connecticut, Rhode Island and Southern and Southeastern Massachusetts, and the far East, all ports beyond Cape Cod, these ports supplying East and Northeastern Massachusetts, most of New Hampshire and all of Maine.

The general policy of the Pennsylvania Railroad during the year was what had been foreshadowed. The shipments of certain coals were restricted to certain markets. For instance, through freight rates are named, that virtually shut out Pocahontas coal from a market that can be supplied with Clearfield. This arrangement reduces selling agencies and shortens rail hauls.

The question mining companies faced at the opening of 1901 was whether railroad control would be wisely exercised. In case production were excessive, would the railroads restrict the output by limiting car supplies all around, or would there be favoritism shown to certain grades of coal and certain companies? Though there were complaints during the year of discrimination, it must be said that the policy of the Pennsylvania Company has been about

as fair as can be expected, under the circumstances. Producers, while paying higher freight rates, have found that there has been a steady attempt to restrict supply to market needs.

While there have been no changes in the policies of railroads, there have been some very large consolidations of interests in the mining fields, particularly in West Virginia. These consolidations have had for their object the securing of more favorable freight rates and a uniform distribution of cars at the mines. In fact, they may be said to act as sales agencies, rather than mining companies.

A notable purchase late in the year was that of the Flat Top Land Association by the Norfolk & Western Railroad. This purchase is in line with certain other tendencies shown by those in control of the Pennsylvania Railroad. But it is not likely that there will be any such wholesale purchases of lands and mines by the soft coal roads as by the anthracite roads in Pennsylvania. Great activity is to be expected in West Virginia, however, as the mines nearer tide water are exhausted and it is said that one of the reasons of the Norfolk & Western purchase was to prevent the possible building of another railroad.

**Trade by Months.**—The year opened with the market in fair shape. The better grades of coal, such as Pocahontas, New River, and George's Creek, were in demand, while Clearfield and the poorer grades were selling slowly; but buying fell off and by the end of the month there was a plentiful supply of even the better grades. The shipping ports were blocked with coal and the railroads were putting embargoes on many producers to keep cars from accumulating at tide water. The Long Island Sound trade was in easier shape than in two years. Freight rates for coast-wise shipments were unusually low. Clearfield coal was selling at \$2.40 and \$2.65 f. o. b. New York harbor ports, with better grades at \$2.85 and over. The consumption of coal did not keep pace with the amount offered for sale, and there was all through February and into March, an accumulation of coal at tide water. Late in February ice hindered shipments to some extent at both loading and receiving ports, but had no particular effect on prices. Some lots of low-grade coal, on which demurrage was accruing, sold as low as \$2.10 f. o. b. New York Harbor shipping ports.

In March all producers cut their outputs sharply. The Bituminous Trade Association held several sessions in New York City, at which it was given out that the prospect for uniform prices was better than ever, and that everything presaged a successful year for the association. There were rumors of probable trouble at some of the mining regions this month that probably brought out a little speculative buying. But the danger of a general strike in the Pennsylvania fields passed when the operators agreed to pay a mining rate of 60 cents per ton for the year. The great majority of buyers make their yearly contracts about April 1. By the end of March contracts began to be taken, but the market was generally dull and there was more or less price cutting in spite of the efforts of the Association. Late in the month the producers announced that they would extend old prices for the coming year. These were as follows: Best grades f. o. b. New York Harbor shipping ports, \$2.85, Clearfield, \$2.65; best grades f. o. b. Philadelphia, \$2.50, Clearfield, \$2.35; best grades f. o. b. Baltimore \$2.43, Clearfield \$2.28; New River coal, f. o. b. Newport News, \$2.50, Pocahontas f. o. b. New York \$2.50; all prices net to the companies.

April opened with the trade still dull, particularly in the far East and along Long Island Sound. Various reasons for this dullness were given; such as the lessened industrial activity, as compared with the year before, and also, the abundant water supply for such industrial establishments as use coal for power only when water is short. The situation did not change materially during April, the better grades were generally firmly held, but the poorer grades were in abundant supply, particularly at Eastern points, and sold at discounts. Heavy arrivals at Boston lead to long delays in unloading and considerable coal was sold under demurrage. Meanwhile

the railroads put embargoes on shipments to keep coke from accumulating at tide water and regulated the supply of cars to producers very sharply. June found the trade quiet and dull, with tide water shipping ports still congested with cars waiting for vessels, and abundant supplies at most ports beyond Cape Cod. Producers complained that many dealers who handled both anthracite and bituminous coal, owing to the interest aroused in anthracite by a new schedule of prices with graded discounts, gave most attention to selling anthracite and did not try to push sales of bituminous. By the end of June conditions began to improve. Prices, however, did not change much. Clearfield, at the beginning of July, was selling at \$2.35 f. o. b. New York Harbor shipping ports, while the better grades were \$2.85.

Trade during July showed very little change. The market for the better grades of coal was pretty firm, producers refusing to sell at less than regular list prices. The poorer grades, however, were in plentiful supply and sold at discounts. By the end of the month labor troubles, which had interfered with industrial activity at many points, were about over, and as mills resumed, demand improved. By the middle of August a very fair tonnage was going from the mines, particularly for points beyond Cape Cod. The market continued to improve during September, though the lower grades were still in over supply. By the middle of October trade was in excellent shape. Demand was very heavy, particularly at Long Island Sound points and in all-rail territory, while New York Harbor trade was steadily improving. Car shortage, or lack of motive power (for the railroads gave first one excuse and then the other) was now the governing factor in the situation and remained such until the end of the year. Car supply at the mines, which, up to the first of October, had been on the whole sufficient, by the middle of the month was less than fifty per cent of the demand, and varied from 25 to 50 per cent for the balance of the year.

During November and December the demand for coal at Long Island Sound and New York Harbor points became very pressing, and all grades sold at full circular figures. By the end of the year consumers were regularly paying \$4 a ton for spot coal f. o. b. at Long Island Sound ports, and \$3.50 a ton at New York Harbor shipping ports, while the coal thus obtained was very often of very inferior quality. In some cases, firms in the bunker trade at New York Harbor paid as high as \$4 for spot coal.

The year on the whole, was a good one, for producers. The total tonnage was considerably in excess of that moved in 1900, while, largely through the influence of the Bituminous Association, prices for the better grades were firmly maintained. With industrial activity assured in the iron trade and many lines of manufacturing this year, the outlook is excellent and bituminous producers have every reason to feel satisfied.

**Coastwise Vessel Freights.**—The coal shipped from the receiving ports to the consuming territories mentioned at the beginning of this article goes forward in floats, barges and vessels. Floats or small barges distribute the coal received at South Amboy and Fort George to the various docks about New York Harbor and the nearer Long Island Sound ports, such as Norwalk, Bridgeport and New Haven. Larger barges and schooners of various sizes go beyond the Sound. The large barges and schooners go to the deep water ports, while the smaller schooners are used for shipments to the smaller yards and shoal-water ports. A noteworthy feature of the coastwise traffic during the past two years has been the great increase in the number of barges as compared with schooners. As an illustration of this, on one day last year, 43 coal barges and 1 schooner arrived at Boston. Some very large schooners have been built recently, but the number of small schooners does not seem to be increasing. The coastwise movement during the year has been but little impeded by storms, and there were no great disasters, such as accompanied the great gale of November 30, 1898. Late in February and early in March, ice gave trouble at both shipping

and receiving ports, but the blockade was comparatively short.

Freights during the most of the year were remarkably uniform and noticeably low, in fact, coastwise freights were lower for a long time than in the history of the trade. The year opened with the low freights of the previous summer still in force. Charters from Philadelphia being 65 cents per ton to Providence, New Bedford and Long Island Sound, and 75 and 80 cents to Boston, Salem, Portland and Portsmouth, while rates from the Chesapeake Bay ports were 10 cents per ton higher. Owing to the many months of low rates, a large number of vessels ordinarily engaged in the coal trade had been taken off shore business to the West Indies, or South America. The result was a scarcity of vessels at the shipping ports, while rates remained low.

During the spring there was no particular change in freight rates. There they were sometimes firmer, sometimes weaker, but vessels were generally scarce. The opening of navigation at the ice-bound Maine ports made little difference, and early in June the rates from Philadelphia were: Providence, New Bedford and Long Island Sound, 60 cents; Boston, Salem and Portland 70 and 75 cents; Portsmouth and Bath, 75 cents; Bangor, 80 cents. These figures did not vary more than 5 cents during the whole summer and rates did not increase until the coal trade was very active and consumers, particularly at Long Island Sound ports and points beyond Cape Cod, were clamoring for coal. The advance came suddenly. On November 16 the rates from Philadelphia were: Providence, New Bedford and Long Island Sound, 65 cents; Boston, Salem and Portland, 80 cents; Portsmouth, 90 cents; Bath 95 cents.

On November 30 the rates were: Providence, New Bedford and Long Island Sound, 85 cents; Boston, Salem and Portland, \$1 to \$1.10. These high rates did not bring out the expected increase in vessels, due in part to the long delays in loading, vessels having to wait sometimes as long as two weeks for cargoes at the shipping ports. Vessels were in better supply in December, but rates remained high and the year closed with charters taken at Philadelphia at 90 to 95 cents for Providence, New Bedford and Long Island Sound, \$1 to \$1.05 for Boston, Salem and Portland, and \$1.10 to \$1.15 for Portsmouth. Prompt loading, however, secured discounts of 10 cents per ton from these rates.

**Foreign Trade.**—Generally speaking, foreign trade was of little importance to bituminous shippers during 1901. No such wonderful stories of openings for American coal abroad were heard as during 1899 and 1900. The small export movement was due to several causes. At the beginning of the year ocean freight rates were high enough to prevent new contracts being taken for European shipment, and by the end of the year, when freights had fallen greatly, the demands of the home market were so strong that foreign business was not wanted. Again, the English operators sold coal during the year at big reductions from the high prices of 1900, when so much was heard of American coals supplanting English in German, French, Italian and Australian ports. As a result American coals could not compete with English at Continental ports early in the year, and the new business taken by American shippers was almost entirely to the West Indies and Central and South America.

The exports of bituminous coal from the United States for the eleven months ending with November aggregated 5,043,221 long tons, a decrease of 600,000 tons from the same period in 1900.

As showing the cost of freight rates during the year, we note that charters were taken early in March from Chesapeake Bay ports to Mediterranean points at \$3.84 per ton. By May the rate had fallen to \$3.12 to \$3.16, and by the end of October to \$2.16 to \$2.22, and was about \$2.28 at the end of the year.

Best Welsh coal, which had sold at \$7.20 in September, 1900, was selling at \$4.80 to \$5.40 f. o. b. Cardiff, Penarth and Barry, at the opening of 1901, and seconds at \$4.56. While best Monmouthshire opened the year at \$4.32 to \$4.56, with seconds at \$4.20.

Prices declined slowly until, by April, best Welsh was selling at \$4.20 to \$4.32; seconds at \$4.08; best Monmouthshire, \$3.72 to \$3.84, seconds \$3.36 to \$3.60. The imposition of an export duty by the English government during that month raised these prices about 20 cents per ton and with a better demand prices advanced until, at the opening of July, best Welsh was selling at \$5.16 to \$5.28, seconds \$4.80, best Monmouthshire \$4.20 to \$4.24, seconds \$3.84. Prices slowly declined, with some fluctuations, during the balance of the year, and early in December best Welsh was \$4.08 to \$4.26, seconds \$4.02, best Monmouthshire \$4.02 to \$4.08, seconds \$3.54 to \$3.78.

#### ALABAMA COAL IN 1901.

FROM OUR SPECIAL CORRESPONDENT.

Alabama coal production for the year 1901, from all indications at present, will be most satisfactory and the State Mine Inspector shares in the opinion that the total output of the mines in this State will not be less than 9,000,000 tons and it may go 500,000 tons above that.

There are 11 counties in the State producing coal. During the past 12 months almost all the mines have been in steady operation, but there was no increased production over the previous year. However, several new mines were opened during the first part of the year and began making steady and heavy shipments and as result there will be a greater production in the State for the year than resulted during 1900.

The following estimates have been made as to the production this year by counties: Bibb County, last year's output, 965,493 tons; increase this year, 124,500 tons; Blount County, last year, 13,490 tons; increase, 75,000 tons. Cullman County, last year, 3,000 tons, no increase expected. Etowah County, last year, 20,255 tons; increase, 30,000 tons. Jefferson County, last year, 5,234,747 tons; increase 484,000 tons. Marion County, last year, 37,000 tons; increase, 73,000 tons. Shelby County, last year, 120,417 tons; no increase this year. St. Clair County, last year, 145,751 tons; increase, 15,000 tons. Tuscaloosa County, last year, 275,172 tons; increase, 30,000 tons. Walker County, last year, 1,417,489 tons; increase, 100,000 tons. Winston County, last year, 15,490 tons; increase, 5,000 tons.

Work was commenced during the year on several mines in virgin coal-fields. The railroads are rendering every assistance possible and spur tracks have been constructed in several cases. The number of employees at the mines in the State increased about 10 per cent in the year. With but few exceptions all of the mining camps in the State are regulated by the United Mine Workers of America organization and during the past year but three camps have been troubled with strikes and they are in Walker County. Knights of Labor, an opposing organization, have taken hold of these mines and are in control of the labor. President Edward Flynn, of Alabama District No. 20. United Mine Workers of America, this month made his annual report to a convention of the miners held in Bessemer, showing that the organization was strong and was gaining membership.

The coming year will see great development in the coal industry in Alabama. Coal mines will be opened on an extensive scale in Walker, Jefferson and Blount counties in particular, while those already in operation will be operated with steadiness.

The coke industry held its own and made slight improvements. Two or three hundred new coke ovens will be put in operation within the next two months and a little later 200 more will be started up.

By-products of coking coal are being saved now in Alabama. The plant of the Semet-Solvay Company at Ensley has been in steady operation all through the year with most satisfactory results.



**COAL MINING IN UTAH.**

BY OUR SPECIAL CORRESPONDENT.

The production of coal by the Pleasant Valley Coal Company, of Salt Lake City, from its mines, which are all situated in Carbon County, Utah, aggregated nearly 1,250,000 tons for the year ending December 31, 1901; and that of coke from the Castle Gate coke ovens 55,000 tons for the same period. The company's mines are situated at Sunnyside, Castle Gate, Clear Creek and Winter Quarters.

At Sunnyside from Mines No. 1 and 2 the daily output will average 1,500 tons of first-class coal. The mines have been worked only during the last two years; but they are now being fitted up with modern and electrical machinery, when the output will be increased to 3,000 tons daily. The vein is about 7 feet thick and the coal good and clean. At Castle Gate there are 520 men employed and the daily output is 1,500 tons. The mine is operated by three parallel entries but a few feet apart, the middle one being used for car service; these entries are 7,800 feet in length and follow the vein on an upraise at a pitch of 7°, the rooms occurring every 70 feet. There are 30 miles of workings and 30 miles of track. The mines are ventilated by a Capell fan and electricity is used throughout, everything being most thorough and up to date. There are 201 coke ovens at Castle Gate with a production of 5,000 tons monthly; the product is shipped mostly to the Salt Lake Valley smelters.

At Clear Creek there are 250 men employed and an average daily output of 1,200 tons is attained. These mines are comparatively in the first stages, as they have only been worked for two years. Development consists of two entries driven on the vein for a distance of 2,500 feet each, one following the coal measures in an easterly direction and the other to the south. At every 500 feet cross-cuts are run and the main vein is 14 feet thick on an average and the coal is first-class. Horses are as yet used for hauling the cars; modern machinery is, however, being installed and electricity will in future be used. At Winter Quarters there are three mines, Nos. 1, 5, and 4. Nos. 1 and 4 are producing, while No. 5 is now being opened up preparatory to being listed with the other producers of this company. No. 1 produces daily about 1,200 tons and No. 4 about 400 tons. These mines give employment to 576 men. The main entry on No. 1 Mine is in 6,000 feet, with a parallel entry for return air of the same length. The vein ranges from 10 to 14 feet in thickness, the dip being 7° from southeast to northwest; the coal is clean and good. The main entry at No. 4 Mine is in a distance of 2,500 feet, also with a parallel entry for return air; the vein is 14 feet thick. There are some 35 miles of tracks used in these two mines and the equipment is thoroughly good and modern.

The Pleasant Valley Coal Company not only supplies Utah with coal, but furnishes an immense quantity to California and the Southern Pacific Railroad, the coal being considered of excellent quality. The mines are under the efficient management of Mr. W. G. Sharp, who is general manager for the company, and the superintendent is Mr. H. G. Williams.

**OIL AND GAS IN KANSAS.**

BY ERASMUS HAWORTH.

During the year 1901 the oil and gas business, particularly the latter, was unusually prosperous. Mr. I. N. Knapp, of Omaha, obtained leases and realty at Chanute, drilled a number of productive oil wells, built a pumping station for pumping oil by compressed air, and has become a regular shipper of oil from the State.

The Forest Oil Company of Neodesha was reorganized and chartered under the laws of Kansas as the Prairie Oil and Gas Company. The refinery at Neodesha was in operation practically continuously throughout the entire year, using the oil from Kansas wells and a small amount shipped in from the South, principally from Bartlesville.

The gas business in the State has expanded much more rapidly than the oil business. At the present

time there is more unused gas available than ever before. The Iola field is holding out remarkably well considering the large amount consumed by the many factories located at Iola, almost every one of which is expanding its business. It is safe to say that the consumption from this field alone during the past year is equivalent to 1,000,000 tons of bituminous coal. The gas territory likewise has been expanded slightly, a few productive wells having been drilled as much as three miles to the southwest of the Neosho river, previously supposed to be a barren area.

At Cherryvale the gas field is now known to be much more extensive than previously considered. The Cherryvale Gas Company has two or three wells east of town, one at least of which has a flowing capacity of 10,000,000 cubic feet per 24 hours and a rock capacity of about 350 pounds. These strong wells are closed at present, because the company has no use for their products, as other wells closer in still meet all the demands made upon them. The Edgar Zinc Company likewise has been drilling new wells with remarkable success, obtaining strong wells with high rock pressure and great flowing capacity, some of which approach the ten million mark.

The most unlooked for development is in the vicinity of Chanute. This territory was prospected years ago and pronounced barren, even by such astute prospectors as Guffey & Galey, yet recently it has become a producer of oil, as above mentioned regarding Mr. Knapp's wells, while gas has been found in large quantities almost in every direction from the city. One strong brick company is operating about two miles south, using gas from their own wells at the factory, and another began operation in January, having its plant located about four miles to the southwest, with gas in great abundance immediately at the plant. The city itself has drilled a number of wells with successful results and has bought the plant at the Chanute Gas Company, which some years ago piped gas into the city from the west. Local wells, however, now entirely supply all domestic consumption.

The Independence Gas Company has put down a few wells to the west and northwest of Independence, some of which have been unusually strong producers, with a rock pressure of about 450 pounds and a flowing capacity of from 10,000,000 to \$12,000,000 cubic feet per 24 hours. This company now has ready for use a number of strong wells which are closed, the old ones meeting all the demands, although the company furnishes all the gas at Independence for domestic lighting and heating and also for a number of manufacturing enterprises, the largest of which is a brick plant owned by the Coffeyville Vitriified Brick Company.

The Coffeyville Gas Company has been drilling quite extensively and has obtained some strong wells. The strongest well in the State is located about three miles southwest of Caney in the extreme southwest corner of Montgomery County and is said to be controlled by the Coffeyville Company, although under the immediate charge of the Caney Gas Company. At 1,490 feet a flow of gas was obtained with a rock pressure of 660 pounds, as measured by Mr. McBride, of Independence, and a flowage capacity of over 15,000,000 cubic feet per 24 hours. This well demonstrates the likelihood of finding gas in other places in the vicinity of Caney and Peru. For a number of years small quantities of gas and oil have been obtained in this territory, which is the farthest to the southwest of any field in the State. The wells drilled here, however, are comparatively shallow, none of them previously having been taken to a depth greater than 1,200 feet, and few of them even to that depth.

In the northeast part of the field new developments have not been so marked. Osawatomie and Paola are supplied from gas lying between the two places, and, strangely, it comes from a depth of from 300 to 500 feet, the shallowest of any gas of importance in the State. Gas has likewise been found still further north in the vicinity of Spring Hill

sufficient to heat and light that thriving village in a respectable manner.

Considerable drilling has been done farther west outside the proven gas field, but entirely without success. As far as has yet been determined no gas may be hoped for west of the line drawn from the center of Chautauqua County on the south to Leavenworth on the north.

**THE GYPSUM CEMENT PLASTER INDUSTRY IN KANSAS.**

BY ERASMUS HAWORTH.

During the past year a number of changes have taken place in the ownership and operation of gypsum mills in Kansas. The mill at Mulvane belonging to the American Cement Plaster Company was closed the last of June. As the company has large interests at Acme, Texas, the closing of the Mulvane Mill did not affect the volume of its business. The mill at Dillon formerly belonging to the Salina Cement Plaster Company was closed and torn down. The mill near Solomon, which for a long number of years was in operation using rock gypsum, was closed more than a year ago.

A number of changes in ownership of properties were made. The Samson Cement Plaster Company, of Burns, with Mr. G. Heller as president, was sold to Mr. A. D. Mackey, of Lawrence, and is still being operated under the old company name. The Salina Cement Plaster Company changed management, Messrs. A. & J. A. Henley, of Lawrence, principal owners of the American Cement Plaster Company, and D. R. Mulvane, of Topeka, becoming the principal stockholders. A new board of directors was elected in June and the offices of the company moved to Lawrence, the business being done practically under the same management with the American Cement Plaster Company. The mill at Dillon, above referred to, was abandoned before this change, so that the Salina Cement Plaster Company thus reorganized is still operating its mill at Longford. The Great Western Cement Plaster Company, of Blue Rapids, was recently bought outright by members of the American Plaster Company and the offices moved to Lawrence, although business is still being done at Blue Rapids under the old firm name. The American Cement Plaster Company, both at Longford, Kansas, and Acme, Texas, use the gypsum earth (gypse erde) which made a brown plaster. With such material it is necessary to use plaster of Paris made from rock gypsum for the third, or white, coat in plastering. The Blue Rapids Mill is operated entirely on rock gypsum so that a white-coat material can be supplied from this mill to all customers of the company. In this way the owners of the American Cement Plaster Company have obtained control of the Salina Cement Plaster Company and the Great Western Cement Plaster Company, and transact the business for the three companies from one office in Lawrence.

At the close of the year 1901, therefore, the following companies are doing business in Kansas:

Name of Company.	Location of Office.	Location of Mills.
American Cem. Pl. Co.	Lawrence, Kan.	Acme, Texas.
Salina Cem. Pl. Co.	Lawrence, Kan.	Longford, Kan.
Great West. Cem. Pl. Co.	Lawrence, Kan.	Blue Rapids, Kan.
Blue Rapids Cem. Pl. Co.	Blue Rapids, Kan.	Blue Rapids, Kan.
Blue Valley Cem. Pl. Co.	Blue Rapids, Kan.	Blue Rapids, Kan.
Wymore Cem. Pl. Co.	Wymore, Neb.	Hope, Kan.
Aetna Cem. Pl. Co.	Kansas City, Mo.	Dillon, Kan.
Samson Cem. Pl. Co.	Burns, Kan.	Burns, Kan.
Roman Cem. Pl. Co.	Kansas City, Mo.	Springvale, Kan.

During the latter half of the year a new company was organized, known as the Aetna Cement Plaster Company. It seems to be a reorganization of the old Aluminite Company. They have obtained possession of the grounds and mill of the old Aluminite Company about 2 1-2 miles south of Dillon and have remodelled the mill, changing it to a four-kettle capacity, and are now in the market with manufactured plaster.

The Roman Cement Plaster Company, with offices in Kansas City and mills at Springvale, Kansas, have been in operation irregularly throughout the year. The mills at Hope, Kansas, likewise have been in

operation, but the name of the company has been changed to that of the Wymore Cement Plaster Company, with offices at Wymore, Nebraska. This was brought about by a Wymore company of jobbers in cements and plasters purchasing the plant.

Rumors are current to the effect that within the next 30 days further consolidations or changes in ownership of plaster mills of America will be effected, even possibly to the inclusion of mills operating upon Michigan and Iowa gypsum deposits.

#### PRECIOUS STONES IN THE UNITED STATES IN 1901

By GEORGE F. KUNZ.

There were more precious stones and pearls imported into the United States, more sold, and more precious stones found in the United States during 1901 than any previous year in our history.

In summing up the leading features of the precious-stone industry of the United States for the year 1901, the following points are the most notable: (1) the continued output of fine blue sapphires in Montana, in Fergus County, and of fancy-colored ones in Granite County; (2) the systematic working of the beryl locality in Mitchell County, North Carolina; (3) an increased production of turquoise from Nevada, and from the New Mexican mines in Grant and Santa Fe counties, together with (4) the large sale of the ornamental stone known as "turquoise matrix," wherein the gem and the gangue-rock are cut together, from all these turquoise mines; (5) a similar cutting of rock and gem, from the emerald locality in western North Carolina, under the name of "emerald matrix;" (6) the mining of the beautiful purple-pink garnets, now known as rhodolite, in Macon County, North Carolina; and (7) the discovery of remarkable colored tourmalines at a new locality in San Diego County, California. To these points may be added, commercially, large importations of diamonds and of Australian opals in the rough, and their cutting in this country; and, with regard to public facilities for study, the presentation to the American Museum of Natural History, New York, by Mr. J. Pierpont Morgan, of the extensive Tiffany collection of American gems and precious stones, from the Paris Exposition of 1900, and of the splendid cabinet of minerals gathered by Mr. Clarence S. Bement, of Philadelphia, both of which collections contained many specimens of gem-minerals of great beauty, the latter only in their natural state.

#### DIAMONDS.

The discoveries reported during the last year are as follows:

In Indiana a  $4\frac{3}{4}$  carat octahedral diamond was found by a farmer in panning for gold on a tributary of Gold Creek in Morgan County. Prof. W. S. Blatchley, State Geologist, informs the writer that several other diamonds have been reported from the same region. These finds resemble those of 1890 on Plum Creek, Wisconsin. They are glacial evidently of the first ice invasion.

In the Southern States are reported a diamond of 13-16 carats found in the vicinity of Knoxville, Tennessee, and another of  $1\frac{1}{4}$  carats in Shelby County, Alabama, making three new finds for the year 1901.

#### SAPPHIRE-RUBY.

Montana.—The Fergus County sapphire mines at Yogo have been actively and successfully worked. The gems occur in a vertical "lead," or "vein," of clay, inclosed between walls of rock—i. e., in a decomposed igneous dike. This material is taken out and washed, and the stones are then sorted. The company operating the mines has worked down some 50 or 60 feet, but exploration to a depth of 200 feet shows the same occurrence of sapphires. Different portions along the dike, however, vary widely in richness.

It is stated that quantities of corundum besides the gem variety are obtained, and that large amounts of it of no present value until railroad transpor-

ation is available, are lying on the dumps. The most important gem yet found here was a very deep blue fine stone of over  $3\frac{1}{2}$  carats.

The Granite County deposits, at Rock Creek, were worked somewhat during 1900, and an attempt was made to trace the gems to their original source in the rock, with what success has not been reported. A large number of gems were obtained from the beds and were cut at Helena. The proportion of red ones—rubies—was greater than heretofore, but none had the deep color of true oriental ruby. They were of light shades of red, beautiful and extremely brilliant, but not so dark as desired. At least sixty occurrences of rubies were located on several miles of gulches, in nearly every instance associated with gold. All the water used in washing them was the result of melted snow and ice of the previous winter.

#### EMERALD.

The emerald and hiddenite mine at Stony Point, Alexander County, North Carolina, is now relieved of the litigation which has hampered it for several years past, during which time nothing has been done there, or at least no discoveries have been reported. Few gem emeralds were found here; but remarkable crystals, finely formed and richly colored, and as much as 10 inches long, translucent to semi-opaque, were taken out about twenty years ago when the mine was first opened.

*Emerald Matrix.*—A novel and attractive stone has recently been brought forward under the name of "emerald matrix." The emerald deposit at Big Crabtree Mountain, Mitchell County, North Carolina, has been lately worked by a New York Company, and, although few transparent gems have yet been obtained, a beautiful ornamental stone has been developed. The crystals vary from one-eighth of an inch to  $1\frac{1}{4}$  inches in diameter, and are rarely over 1 inch in length. They are not transparent, but have rather a fine emerald color, penetrating narrow veins of quartz and feldspar in an irregular manner. This green and white mixture is very pleasing; and as the feldspar has a hardness of 6.5, the quartz of 7, and the emerald of about 8, the whole can be cut and polished together. Pieces are cut *en cabochon*, showing sections of one or more emerald crystals on the top and sides of the polished stone.

*Beryl Crystals.*—Very large opaque crystals of beryl, like those from Acworth, New Hampshire, and smaller crystals of gem quality, have been found near Blandford, Massachusetts. The large crystals occur in ledges of white quartz rock, and are quite abundant and of great size. The small ones are found in boulders and stone fences; their source is not yet known, but must lie to the north, in the line of glacial transportation. Some of the crystals are reported as highly valuable for gem purposes.

#### TOURMALINE.

Recent discoveries in Southern California have revealed a locality of colored tourmalines that bids fair to become famous. A ledge of quartz and lepidolite, at an altitude of nearly a mile, on Mesa Grande mountain, San Diego County, is found to be full of tourmalines of great variety. As compared with the well-known locality of pink tourmalines in lepidolite at Palo, Cal., this new occurrence differs in presenting large and separate crystals in both lepidolite and quartz, many being translucent or even transparent, and with perfect terminations. Rubellite is the prevailing variety; but all the colors occur, sometimes several in one crystal—both in transverse sections, as at the Maine and Connecticut localities, and in concentric zones, as often in Brazil. Besides these there are some large and perfectly colorless achroites, and some choice yellow specimens. Frequently rubellite or other colored crystals have a thin dark green or nearly black outer shell or coating, characteristic of this locality. Many gems have already been cut; and as specimens, the crystals are magnificent. A number of single rubellites, only partially perfect, weighing up to 70 carats each, and

occasional yellow, green, and white gems, have also been found here.

#### AGATIZED WOOD.

The celebrated "Petrified Forest" near Holbrook, Ariz., has been brought within easier access for tourists by the establishment of the new railroad station named Adamana, whence it can be reached by a drive of 6 miles, although the most remarkable portions lie several miles farther southward. Most travelers visit only this nearer part, and the other sections are less known. Dr. Lester F. Ward of Washington, in a report to the Director of the United States Geological Survey, fully describes the entire area. Dr. Ward visited the region in November, 1900, under directions from the General Land Office and the Smithsonian Institution, with a view to securing some such action for its protection as that advocated by the Arizona legislature several years ago. He strongly recommends the withdrawal of the area of the petrified forest from private entry and advises its reservation as a national park.

The locating of a nearer station, with easier access to these unique localities, renders more important than ever some form of Government oversight of these natural treasures of priceless interest. It is a place that interests tourists from all lands as well as the geologist. The original source of the agatized wood, the beds in which the trees grew, must be sought higher up, and perhaps at some distance, in strata previously eroded to form the sandstones into which the trunks were borne. It was originally an early Triassic land at an elevation of fully 500 feet, which was invaded and covered up by Mesozoic seas and not raised until the great post-Cretaceous elevations began that have lifted this entire region a mile above the present sea level.

A magnificent display of this agatized wood (the richest American ornamental stone) cut and polished sections of trunks, of the richest colors, and various ornamental articles made therefrom, was shown at the Pan-American Exposition at Buffalo, as also at the Paris Exposition in 1900. At the former there were three separate exhibits, one in the Mines building, one in the Manufactures and Arts building, and one in a small pavilion apart. These exhibits were made by the Drake Company of Sioux Falls, N. Dak., where the great cutting and polishing works for this hard material are operated by water-power, and where work of this kind is done that is not surpassed anywhere in the world, not even in the great government lapidary works of Russia.

#### TURQUOISE.

Turquoise was actively mined for in the past year. A feature of the American turquoise companies is that many of them give a guarantee that if a gem changes in color before the expiration of six months after its purchase from a retail jeweler they will replace the stone by a new gem of unchanged color. Several companies claim that these gems never change, which, if always so, would seem remarkable for a mineral so long known as of a somewhat unstable character. This guarantee, however, is a great advantage over the ancient method of the Persian selling his gems and departing for lands unknown the day of the sale. The various companies protect themselves by engraving a trademark on the backs of the cut stones, with an A for American, an O for Azure, a + for American Turquoise and Copper, a T for Toltec, etc. There are at least six companies actively engaged in mining this beautiful stone at the present, with companies on the increase. It is a question of time how much output the market will stand.

IMPORTS OF IRON ORE INTO GREAT BRITAIN.—Imports of iron ore into Great Britain for the 11 months ending November 30 were 5,077,667 tons, against 5,755,279 tons for the corresponding period last year; showing a decrease of 677,612 tons. Of the total this year 4,347,048 tons, or 85.6 per cent, came from Spain.



**BAUXITE IN 1901.**

By WILLIAM G. NEILSON.

In the *Transactions* of the American Institute Mining Engineers, Vol. XVI, July, 1887, there is a short paper by Edward Nichols, announcing the finding of "an aluminum ore" in Floyd County, Georgia.

Mr. Nichols made this discovery about 1884 or 1885.

The first car-load shipment of this ore was made in 1889, 728 tons being shipped during that year. This was the beginning of the bauxite mining business in the United States. In 1890, 1,844 tons were shipped. The shipments during these two years, were made by the Republic Mining and Manufacturing Company, of which Mr. Nichols was president. In 1891 shipments from Alabama were commenced by the Southern Bauxite Mining and Manufacturing Company, and in 1892 the Georgia Bauxite and Mining Company entered into the business. Probably nearly 95 per cent of the bauxite shipped from the Georgia-Alabama district has been mined by the three companies named.

The Georgia Bauxite and Mining Company (connected with the Pittsburgh Reduction Co.) closed its business in the district, making its last shipments in 1900, and the Pittsburgh Reduction Company has commenced mining in Arkansas. The Republic Mining and Manufacturing Company and the Southern Bauxite Mining and Manufacturing Company continue operations in the Georgia-Alabama district; the latter company has, however, secured a very extensive property in Arkansas, and is also conducting business there.

The following tabular statement shows the carefully estimated shipments of the Georgia-Alabama district from the beginning of the business to the close of the year 1900. The shipments for 1901 will probably not greatly vary from those of 1900:

*Shipments of Bauxite for Georgia-Alabama District.*  
(Tons of 2,240 lbs.)

1899	728 tons
1890	1,844 tons
1891	3,593 tons
1892	10,518 tons
1893	9,179 tons
1894	11,066 tons
1895	17,069 tons
1896	18,364 tons
1897	20,590 tons
1898	24,331 tons
1899	29,943 tons
1900	19,841 tons
The total in 12 years was 167,066 tons.	

A similarly prepared table of shipments from Arkansas is as follows:

*Shipments of Bauxite From Arkansas District.*

1896	40 tons
1897	...
1898	613 tons
1899	3,000 tons
1900	3,565 tons
The total in 4 years was 7,218 tons.	

In 1901 the shipments from Arkansas have not been large, probably 1,600 or 1,700 tons, but with additional railroad facilities, recently secured, a considerable increase may be anticipated for 1902.

**THE CHEMICAL MARKET IN 1901.**

By C. C. SCHNATTERBECK.

**Heavy Chemicals.**—The increased domestic production, coupled with the high tariff, has resulted in a marked fall in imports, especially of the soda compounds, bleaching powder and chlorate of potash. Prices in most lines, however, were more satisfactory than in 1900.

Importers of bleaching powder booked contracts on the basis of \$2 per 100 lbs. for prime Liverpool, and at \$1.75 to \$1.87½ for Continental makes, while second hands quoted ex-dock business at less than these quotations. New 1902 contracts were taken in the last quarter of the present year at \$1.75 to \$1.90 for prime Liverpool, and at \$1.70 to \$1.85 for Continental brands. Domestic high test bleach prices were based on those quoted by importers.

**Domestic alkali** was in good request at the glass works. Makers quoted f. o. b. 75 to 85 cents per 100 lbs. for 58 per cent, and 80 to 90 cents for 48 per cent, the market being particularly strong in the last half of the year, owing to comparatively small stocks, and the destruction by fire of a large plant

in the Middle West. New 1902 contracts were booked at 77½ to 82½ cents, f. o. b. works, according to test. Foreign sold around 85 to 87½ cents per 100 pounds in New York for 1901 shipment.

**Caustic soda**, besides finding ready sale among glass makers, has shown an improved demand from mercerized goods manufacturers. Domestic high test caustic soda fluctuated between \$1.70 and \$1.95 per 100 pounds, f. o. b. works, while new 1902-1903 contracts were made at \$1.85 to \$1.92½ f. o. b. works. The foreign article was sold during 1901 at \$1.85 to \$2.50 per 100 pounds in New York, but imports are only about half what they were in 1900. Next year's business has been done in Liverpool, Eng., at the reduced rate of £8 15s. for 60 per cent, £9 15s. for 70 per cent, £10 5s. for 74 per cent, and £10 10s. for 76 per cent, per ton, net cash.

**Sal soda** imports are much less than 1900; but the domestic industry has grown. Prices were weakened by competition, especially in the West. In the East sales were made f. o. b. works at 50 to 55 cents per 100 pounds, while foreign brought 65 to 67½ cents in New York.

**Bicarb. soda** of ordinary quality has suffered from competition, and prices are therefore lower than last year. Domestic makers sold at 95 cents to \$1.10 per 100 pounds f. o. b. works. The extra grades, being largely controlled by one firm, remained unchanged at \$3.25 to \$3.50 per 100 pounds f. o. b. works, less the usual discounts. Foreign ordinary grades brought \$1.37½ to \$1.75 per 100 pounds in New York.

**Chlorate of potash** finds a large sale with gunpowder manufacturers. The growing importance of the domestic production of chlorate of potash is accentuated by the large decrease in imports. Prices were weak, owing to aggressive competition. Domestic crystals sold in New York at \$8 to \$8.50 per 100 pounds, and powdered at \$8 to \$8.75; while foreign crystals brought \$9 to \$10.25 per 100 pounds, and powdered, \$9.25 to \$10.75. Contracts for 1902 domestic were booked at \$7.50 to \$7.75 per 100 pounds, as against \$8.25 paid for 1901 contracts. There were also contracts for 1902 Continental at \$7.50 to \$7.75.

**Arsenic.**—Glassmakers have been large buyers, at lower prices than last year. Competition reduced the New York quotations for white from \$4.75 to \$5 per 100 lbs. in February, to \$3.12½ to \$3.25 in December, while red brought \$7 to \$7.50 per 100 lbs.

**Potassium Ferrussiate.**—Domestic production of yellow (ferro-cyanide) was curtailed somewhat by the burning of the Mutual Chemical Company's plant in New Jersey early in the year. These works had an annual capacity of fully 1,000,000 lbs. Prices, however, suffered from competition, and from 14½ to 16 cents per lb. ruling for some months; the close in December was weak at 13½ cents. The chief uses were for the preparation of potassium cyanide and ferricyanide, and prussian blue. Red prussiate of potash (ferricyanide) was in moderate request for dyeing, and as an oxidant in calico-printing. The price fluctuated little from 37 cents per pound in New York.

**Copperas.**—The heavy domestic production, owing to active work by the new Eastern plants, has made competition aggressive, reducing prices from 45 to 30 cents per 100 pounds in bulk. These quotations are much less than those scheduled by the last producers' combination.

**Chrome Ore and the Bichromates.**—Consumption has improved, and though chrome ore was quoted higher than last year, makers of the bichromates have reduced their prices, owing to competition. For 50 per cent chrome ore ex-ship New York the extreme quotations were \$26 per long ton in January, and \$24.50 in December. Domestic bichromate of potash sold at 8¾ to 8½ cents per pound, against 8½ to 9¼ cents last year, while the Scotch article brought about ¼ cent per pound more. Bichromate of soda sold at 6¾ to 6¼ cents per pound. Chrome bricks for furnace lining remained unchanged at \$175 per 1,000, f. o. b., Pittsburg, Pa.

**Cyanide of Potash.**—Consumption in this country has been large, owing partly to the erection of new gold recovery plants in South Dakota, and other

Western States. Prices, however, are 4 cents per pound lower than last year, owing to the heavy production of cyanide in England and Germany, and the large accumulation of stocks as a result of the continued small consumption in the Transvaal. New York importers quoted 24 to 25 cents per pound for 98 to 99 per cent cyanide, while last year the prices were 28 to 29 cents.

**Sulphuric Acid.**—The fertilizer factories, textile and paper mills, and soda water manufacturers were all large consumers during the year. The trade in the East is controlled chiefly by the General Chemical Company, which has kept prices at a satisfactory level. As the year advanced prices were raised to meet the higher cost of raw material. In New York selling quotations ranged from \$1.10 to \$1.30 per 100 pounds for 66° acid in carboys; 90 cents and \$1.10 for 60°, and \$12 to \$16 per ton for 50° acid in bulk.

**Nitric Acid.**—Demand has improved, and prices continued firm owing to the high cost of nitrate of soda. New York prices, for carboys, were: 30°, \$3.62½ to \$4, per 100 pounds; 38°, \$3.87½ to \$4.35; 40°, \$4.12½ to \$4.87½; 42°, \$4.37½ to \$4.87½. Large quantities have been bought by the textile mills, and precious metal refiners.

**Muriatic Acid.**—Well contracted for at high prices. In New York quotations for carboys were: 18°, \$1.20 to \$1.50 per 100 pounds; 20°, \$1.35 to \$1.62½; 22° \$1.50 to \$1.75.

**Oxalic Acid.**—Competition brought prices to a level where makers could realize but little profit. The extreme quotations during the year were \$5.87½ and \$4.75 per 100 pounds for the commercial article. Next year's contracts were booked on the basis of \$4.75 to \$4.87½, according to seller and quantity.

**Copper Sulphate (Blue Vitriol).**—The foreign trade has taken a larger quantity than last year, and prices have been well maintained, owing to the firm copper market up to December. As an insecticide copper sulphate has found its largest sale in the currant and grape vineyards of Continental Europe. Large quantities have also been used for preserving railway sleepers, telegraph poles, etc. In the United States the important consumers are the telegraph companies.

The exports to all countries from New York alone in the 11 months, ending November 30, were 37,356,228 pounds, valued at \$1,758,791, which is equal to nearly 80 per cent of the total shipped from all United States ports. Of the New York exports, Italy received 27,499,645 pounds, or 73.6 per cent of the total; Austria, 3,450,856 pounds; France, 1,857,731 pounds; Portugal, 1,263,123 pounds, and Holland, 1,255,121 pounds.

Prices in New York were highest in the early months of the year, when exports were heaviest and sellers quoted \$5 to \$5.25 per 100 pounds. The lowest prices were \$4.12½ to \$4.37½ in August; thereafter until the close of the year, fluctuations were between \$4.50 and \$5.

**Pyrites.**—Demand has been brisk, and deliveries on contract large at good prices. Domestic production has grown, especially in the South, and imports during the year are fully 17 per cent above 1900. The imports into the United States in 1901 are estimated at about 389,000 tons, chiefly from Spain. These large imports were favored by comparatively low freight rates from Huelva, Spain, being \$1.92 to \$2.34 per ton to Atlantic ports. Spanish pyrites carrying from 46 to 51 per cent sulphur were sold at 12 to 14 cents per unit (\$5.52 to \$7.14 per ton) ex-ship, Atlantic ports. Domestic pyrites, containing 42 to 44 per cent sulphur, sold f. o. b. Mineral City, Va., at \$4.90 per ton for lump ore, and 10 cents per unit for fines; while at Charlemon, Mass., the prices were \$5 to \$5.50 for lump, and \$4.75 to \$5 for fines.

**Brimstone.**—Owing to high prices and increased consumption of pyrites by acid makers, the imports of brimstone are approximately 7,000 tons less than in 1900. The total imports into the United States in 1901 were about 160,000 tons, chiefly in best un-mixed seconds, which were consumed largely by paper mills.

Prices were well maintained by the trust in Sicily nearly all through the year, and would have continued to rise had not the large stocks in producers' hands in the last quarter compelled the Anglo-Sicilian Company to make concessions. On November 30 these stocks were fully 288,000 tons, which compares with 228,428 tons at the same time in 1900; showing an increase of about 60,000 tons. Below we give a table, showing the statistical position of best unmixed seconds during the past year:

New York.			Sicily.		
Month.	Spot.	Shipments.	U. S. Imports.	Quota-tions.	U. S. freight rate.
January	22.38	21.45	13,315	18.42	1.74
February	23.03	21.38	2,775	18.84	1.80
March	24.88	21.76	6,009	18.72	1.68
April	21.78	21.19	27,139	18.48	1.65
May	21.63	21.38	13,951	19.14	1.65
June	22.38	22.16	8,187	19.32	1.62
July	22.38	21.73	14,587	19.32	1.62
August	22.38	21.72	17,978	19.74	1.62
September	22.40	22.20	13,720	19.92	1.83
October	24.65	22.83	9,590	20.10	2.16
November	24.19	22.72	15,400	20.10	1.80
December	23.34	22.69	10,000	20.10	1.80
Year	22.95	21.93	152,651	19.35	1.75

As compared with the year 1900, the New York prices show an increase of 77 cents a ton in spot, and 82 cents in shipments. Best unmixed thirds sold in New York at \$2 to \$3 per ton below best unmixed seconds.

**Sulphate of Ammonia.**—Fertilizer manufacturers have been good buyers of 24 to 25 per cent gas liquor, which resulted in a larger domestic production than in 1900, and fairly heavy imports from Great Britain. The recovery of sulphate of ammonia from coal in the by-product coke oven is growing in importance in America. Prices fluctuated around last year's close and large sales were made at \$2.70 to \$2.85 per 100 pounds.

**Nitrate of Soda.**—Trade in this country has been good, and prices high, during 1901, owing to the large consumption by fertilizer and gunpowder manufacturers. It is estimated that the deliveries at Atlantic ports were fully 1,246,000 bags, which compares with 1,176,651 bags in 1900; showing an increase of 69,349 bags, or over 5 per cent. The largest deliveries were made in February, 141,878 bags, May, 131,827, November, 128,032 bags, and August, 122,303 bags. The average prices at New York during these months were: February, spot, \$1.82 per 100 pounds; and shipments, \$1.83¾ to \$1.85; according to position. May, spot, \$1.84, and shipments, \$1.82½ to \$1.95; November, spot, \$1.89, and shipments, \$1.92½ to \$1.95; August, spot, \$1.90, and shipments, \$1.95. The average sale price in the whole of 1901 was \$1.86 per 100 pounds, for spot, while the extreme quotations on shipments were \$1.80 in March and \$1.97½ in September. These shipment prices compare with \$1.60 and \$1.85, the lowest and highest during 1900; showing an improvement in the past year of 12½ cents to 20 cents per 100 pounds. The spot prices averaged the same in 1900 as in 1901, as orders taken on this basis are usually of a retail character to fill a hand-to-mouth demand.

In Europe the market has been unsettled by the high prices and subsequent accumulation of stocks at leading ports. The total imports in 1901 are estimated at about 1,187,170 long tons, which is fully 7 per cent more than last year, while the deliveries, amounting to 1,149,000 tons, showed only a small increase. On December 1 the visible supply, including stocks and cargoes afloat, was reported at 573,290 tons, which compares with 793,640 tons on January 1, and 671,440 tons on December 1, 1900. Prices in Liverpool, England, opened in January at £8 10s. to £8 15s. per ton f. o. b., less 2 ½ per cent for double bags, and closed the year at £9 10s. to £9 12s. 6d. These prices compare with £8 to £8 5s. and £8 10s. to £8 15s. at the corresponding periods in 1900; showing an advance in 1901 of 10s. to £1 per ton. This advance has been severely felt by the beet sugar planters in Germany, France and Austria, who are rated among the heaviest consumers in the world.

Production of nitrate of soda in Chile has been well regulated by the quantity exported, and prices

has been very satisfactory to the oficinas, owing to the combination.

The combination began active work on April 1, last, and allotted the production for the year ending March 31, 1902, on an exportation of 31,273,000 quintals. Subsequently, however, it was agreed that only 75 per cent of this quantity should be exported during the 9 months from April 1 to December 31, 1901, in order that the production may be more evenly distributed. Consequently, the total exports in the year ended December 31, 1901, aggregated about 26,000,000 quintals, against 31,549,653 quintals in 1900; showing a decrease of 5,549,653 quintals, or 17 per cent. The production in 1901 was approximately 28,681,167 quintals, which compares with 32,474,583 quintals last year; showing a fall of 3,793,416 quintals, or 12 per cent. It is noteworthy that good dividends have been paid by many oficinas, and operations have been more economical, as the costras, ripios and cuevas caliche are now being utilized, whereas they were previously considered waste products. The cost of producing nitrate of soda has changed little, as more care is being taken in its manufacture and marketing. The propaganda of nitrate in the European market has been active, but it is likely to be checked in the coming year, as the Chilean Government has refused to extend the subsidy of £20,000 to the Permanent Nitrate Committee in London for this purpose.

Prices alongside steamer quoted by the oficinas for the 95 per cent quality were 6s. ½d. per quintal in January, receded to 5s. 10½d. in March, when production was heavy, and exports less than the two previous months; but in April prices recovered in accordance with the combination's wishes, until, in October they had touched 6s. 11d., which compares with 5s. 10d. in December, 1900, the highest in that year.

Contracts for 1902 deliveries of the 95 per cent quality have been booked at 6s. 2d. to 6s. 8d. per quintal. The 96 per cent, or refined quality, for early shipment fluctuated between 6s. 1d. per quintal in March, and 6s. 10d. in October, while 1902 orders alongside steamer were taken at 6s. 3d. to 6s. 9½d. These prices for 96 per cent show a good advance over 1900. Ocean freights from Chilean ports have been much lower than last year. The lowest rate in 1901 was 21s. 3d. in January, April and May, and the highest 28s. 3d. in September. The extreme rates in 1900 were 28s. 9d. and 38s. 9d.; recording a fall in 1901 of £7 6s. to £10 6d. per ton.

**Potash Salts.**—Consumption in the fertilizer industry in this country is large, and the imports of muriate of potash alone show an improvement of fully 10 per cent over last year. Prices quoted on contracts by the agents of the German Kali Works, who control the business here, were as follows: Muriate of potash, 80 to 85 per cent, \$1.83 per 100 pounds; and 95 per cent, \$1.86; sulphate of potash, 90 per cent, \$2.11 per 100 pounds, and 96 per cent, \$2.13 to \$2.14; double manure salt, 48 to 53 per cent, \$1.12 per 100 pounds; manure salt, 20 per cent, 64 to 66 cents per 100 pounds; kainit, 12.4 per cent potash, \$9.05 per long ton; sylvinit, 38½ to 39½ cents per unit of sulphate of potash.

**Phosphates.**—The last six months were the most active during the year, though shipments were interfered with by the short car supply. Export trade was 17 per cent larger than last year, about 750,000 tons having been shipped, against 619,996 tons in 1900. This improvement was due partly to the low freight rates, which enabled shippers to compete abroad at rather low prices. Our best customers were Germany, Holland, Belgium, France and Italy.

At producing centers efforts were made to consolidate, but so far Tennessee alone appears to be successful, though in South Carolina the Southern fertilizer trust has already obtained an important footing. In Florida, miners in the different districts are still undecided, but it is likely something definite may be done in the near future, as certain leading exporters in the hard-rock field are strongly in favor of a community-of-interest plan to regulate the industry and maintain prices.

In Florida, phosphate prices were lower than last year. The largest business was done in high-grade rock, the exports of which amounted to fully 428,000 tons, or about 80,000 tons more than last year. German superphosphate manufacturers were the largest consumers. Selling prices delivered abroad were: January, \$12.53 per ton; February, \$12.14; March, \$11.85; April, \$11.62; May, \$11.22; June, \$10.73; July, \$11.40; August, \$11.36; September, \$11.36; October, \$11.31; November, \$10.92; December, \$10.92; year, \$11.45. The quotations f. o. b. Fernandina averaged \$7.25 per ton, in January, \$6.75; from February to November, inclusive, and \$7.25 in December; making a yearly average of \$6.83 per ton. Land pebble showed a good demand, chiefly for home consumption, while export orders were larger than last year. It is estimated that exports aggregated fully 115,000 tons, principally to France, Italy and Germany. The average monthly c. i. f. prices were: January, \$9.51; February, \$9.45; March, \$9.10; April, \$8.88; May, \$7.39; June, \$8.53; July to October, inclusive, \$8.49; November and December, \$7.70; year, \$8.52 per ton. The f. o. b. Fernandina prices averaged \$4.14 in January, \$3.93 from February to September, inclusive; \$3.75 in October, and \$3.13 in November and December, making the yearly average \$3.80. Peace River stuff was not as active as last year, and shipments abroad have been less. In 1901 the exports were reported at 18,790 tons, which compares with 21,427 tons last year. Great Britain received a good part of these exports. Abroad prices averaged monthly as follows: January, \$7.88; February, \$7.50; March, \$7.80; April, \$7.60; May, \$7.39; June, \$7.28; July, \$7.35; August, \$6.90; September to December, inclusive, \$6.30; year, \$7 per ton. The f. o. b. prices averaged \$2.94 per ton in January, \$2.63 from February to October, and \$2.38 in November and December, making a yearly average of \$2.61 per ton.

Tennessee phosphates were in good request, and a growing export trade is noted, especially with France and Italy. Over 130,000 tons of high-grade rock was sent abroad this year. Competition, however, resulted in lower prices than were taken in 1900. As averaged the c. i. f. quotations were: January, \$11.12; February, \$11.02; March and April, \$10.73; May, \$10.65; June, \$10.34; July to December, inclusive, \$10.73; year, \$10.76 per ton. The f. o. b. prices of export rock were \$2.88 in January; \$3.25 in February; \$3.38 in March to July, inclusive; \$3.68 in August and September; \$3.30 in October; \$3.31 in November, and \$3.50 in December, making the yearly average, \$3.33. Domestic orders for high-grade rock were taken at prices that averaged \$2.78 in January and \$3.13 in December, or \$2.97 for the year, f. o. b. Mt. Pleasant. The 75 per cent grade averaged \$2.63 in January, and \$2.88 in December, or \$2.75; and the 70 to 72 per cent grade, \$2.13 in May to July, \$2.29 in September and at \$2.25 in December, or \$2.21 for the year; all f. o. b. Mt. Pleasant. Better prices are expected next year, as the combination, headed by prominent exporters, will endeavor to support the market by regulating the industry.

In South Carolina heavy stocks in the early part of the year and small demand necessitated the curtailment of production. Prices were sympathetically weak, but the opportune understanding between one of the leading producers and the Southern fertilizer combination, prevented serious demoralization in the market. Shipments coastwise show a decrease from last year, and exports to Great Britain and France have also been less. Abroad competition is keen with the Algerian stuff. The monthly average c. i. f. selling prices of South Carolina dried rock were \$7.80 in January and February, and \$5.98 in December, making an average for the year of \$6.88 per ton, which compares with \$7.08 for Algerian 58 to 63 per cent rock. The average f. o. b. prices at Ashley River for dried rock were \$4.50 in January and February, and \$3.25 in March to July, making, \$3.65 for the year, while the crude rock, of which comparatively little has been sold out of the State, average \$3.36 for the year.



Ocean freight rates were lower than last year, charters being booked from Florida ports to the United Kingdom at \$3.72 to \$4; Continent, \$2.64 to \$3.90; Baltic, \$5 to \$5.28; Mediterranean, \$4.20 to \$4.56; Japan, \$9, and to Melbourne, Australia, \$5.25. From Savannah, Ga., to the Continent, \$3.16 to \$3.60, and from Pensacola to France, \$4.80.

### THE SUDBURY DISTRICT, ONTARIO.

By OUR SPECIAL CORRESPONDENT.

In July last, Captain C. M. Boss was engaged by the Lake Superior Power Company to superintend the work of opening up the Elsie Mine. The only development work that had previously been done on the property was a little surface stripping, but that exposes a fine natural outcrop of ore. The extent of the deposit was partly ascertained with a diamond drill, and mining operations were started by an open cut 50 by 100 feet. Shipments of ore were commenced within three months, and now amount to 250 tons a day. This is considered the most expeditious work that has ever been done in mining in the Sudbury District. The company is erecting a smelting plant near the Gertrude Mine, and about 180 men are employed at the two mines and in putting up the works. A few car-loads of the ore have been shipped to Sault Ste Marie to extract the sulphur from it for the pulp mill there.

At the Victoria Mines one of the two large furnaces at the works of the Mond Nickel Company, has been kept going almost continuously for the past six months, and also the bessemerizing plant most of the time. This company has one good big mine in Denison, and employs about 300 men in the mine and works. The average output of ore is 200 tons a day. Total output for the year, 48,000 tons. The grade of the matte made by the smelter is 30 per cent in combined nickel and copper, and which is raised to 80 per cent in the bessemerizing works. The payroll is \$11,000 a month. Hiram W. Hixon is the local manager of the company's business. The matte is shipped to the Mond nickel refinery in Wales.

During the last half of the year the total aggregate output of all the mines that are being worked in the district was over 1,500 tons a day. Twelve smelting furnaces have been constantly running the whole time, and two additional furnaces are soon to be added to one of the plants.

The much discussed question of refining the nickel in Canada will likely be solved within the year. An application is to be made to the Ontario Legislature at the coming session for a charter, presumably by two of the leading companies in the district, for this purpose. The works are to be located on the Spanish River near Massey Station.

A well-known duke in France has purchased a fine site two miles east of Sudbury with the intention of erecting thereon a large smelting plant next summer to treat nickel ores.

Nearly all the mining companies in the district use coal now for power instead of wood, as formerly, and for two reasons; coal gives more even power and also costs less.

### THE PETROLEUM INDUSTRY OF CALIFORNIA.

By GEORGE H. ELDRIDGE.

There are at present many phases to the petroleum industry of California as viewed by the general producer, but none is of greater interest than the market. This depends upon the railroads, the refiners and the general consumers, and in a considerable degree upon one or two of the larger companies that may not only buy for refining purposes, but for transportation and storage against future higher prices with the intention of reselling.

The demand by the railways is large and continuous, but they themselves are large producers, in addition to purchasing on long time contracts at figures very remunerative to the seller. It seems quite probable that in the renewal of contracts, fuel oil will be obtained at materially lower prices, but the demand

will unquestionably increase as the replacement of coal-burning with oil-burning locomotives proceeds and the development of traffic attendant upon the natural conditions of commerce on the Pacific Coast is brought about.

The refiners also are both producers and consumers. The larger companies, however, are extensive buyers of oil as low in gravity as 14° B., and to care for the product, in one field alone—the Kern River—are erecting tanks of an immediate aggregate capacity of over 1,000,000 barrels, with the apparent intention of doubling this in the near future. This work has doubtless been entered upon only after most careful consideration of commercial and technical conditions, and with the laying of pipe-lines to the seaboard, constitutes a most encouraging feature bearing upon the future of the industry. The accumulation, however, of great quantities of petroleum in a few hands is very likely to have a distinct influence upon prices, a factor to be at all times considered by those engaged in or entering upon the production of oil.

The use of petroleum as a fuel among the general industries of the State is markedly extending, and at the present time shipments are being made to the Hawaiian Islands, where a saving of between \$2 and \$3 per ton of coal formerly used is the result attained by the planters in the change. To one familiar with the relation of fuel supply to the commercial development of a region, there is but one conclusion as to the future of the petroleum industry of the Pacific Coast.

The prices of fuel petroleum at the wells in 1901 that have come to the writer's knowledge vary from 15c. to \$1.42 per barrel, the latter, a single instance based upon a long-standing contract. Recently there has been reported a contract of several million barrels extending over a period of years at 25c. at the well, and this may prove a not uncommon figure of to-day. The lowest price, 15c., is accepted chiefly by those whose capital is limited and who are required by the terms of their lease or otherwise to prosecute drilling uninterruptedly. This price is, however, for fuel oil of 12° B. to 15° B., oils of lighter gravity but of the fuel class bringing a somewhat higher figure. The petroleum of 28° B. to 40° B. command, of course, a much higher price. These go to the refineries. A satisfactory review of the year's prices of petroleum is most difficult, so closely guarded are the figures by both buyer and seller.

The present cost of producing a barrel of fuel oil from wells 800 to 1,400 feet deep, exclusive of the cost of the well, is, according to the best authorities, between 10 and 15 cents, these being the limits given the writer by some of the larger and older companies. Five or six cents is not infrequently reported as the "cost of production," but this does not include interest, repairs, enforced idleness of a well, loss by fire or wind, or a sinking fund against the exhaustion of the strata. Economies will sooner or later come through the utilization of natural gas for pumping; through the increased efficiency of labor; through improvement in management, with acquired experience; and through consolidation, which is already under way and will rank first in the reduction of expenses. Opportunities for improvement of the technical side of the industry are glaringly conspicuous to the most casual observer, but the condition is that attendant upon nearly all new mining enterprises. It is of interest that in all the fields success has been attained in proportion to the business acumen of the management; the careful study of every phase of the industry; the preservation of the most complete well records for future reference; the early investigation of important technical questions; and alertness in placing contracts.

In some of the older fields, which are also fields of lightly producing wells, 10 to 15 barrels, and high gravity oil, 20° B. to 40° B., economies have been advantageously practiced for a long time. Gas is altogether employed in pumping; the wells are operated as far as possible from central plants; labor is reduced to a minimum; and the management is upon conservative lines, founded upon experience.

The values of California oil lands vary widely for

different fields; different parts of the same field; even for the different quarter sections. Although proven territory has by far the highest first cost, the writer believes with an advantageous lease it is the cheapest. Leases, however, are reported as having been made upon the basis of a royalty of 50 per cent of the production and an agreement on the part of the lessee to bore, in some instances, as high as 8 or 10 wells annually for a period of 3 years. Such a lease is likely to prove unremunerative except in the richest territory. Most of the leases are far more advantageous than this.

In the Kern River field the oil-producing strata amount locally to over 400 feet, all available; the wells of the same locality yield from 150 to 250 barrels per day—in some instances more. As a means of estimating values, the yield of a stratum saturated to 10 per cent of its volume may be taken at 777 barrels per acre-foot. The writer's examination of exposed bituminous sandstones in California two years since leads him to believe this conservative; in several instances 14 to 16 per cent were found present in considerable bodies of sand. In the past year especially selected land in the Kern River District has been reported as valued at \$20,000 per acre. This would require 160,000 barrels of oil netting 12½ cents per barrel to equalize the purchase price, approximately the product of 200 acre-feet at a saturation of 10 per cent by volume.

The developments of the past year have been more marked in the San Joaquin Valley than in the southern fields of California, although in all of the latter advance is indicated by a number of new wells. In the San Joaquin Valley the Middle Neocene sandstones have proved wonderfully productive, the wells ranging from 25 to 700 barrels a day, of an oil varying for the different fields from 12° B. to 20° B. In most of the Valley fields, the formation lies at a gentle angle of dip, the McKittrick, where the strata may be even overturned, being the single exception. In southern California the fields along the Santa Clara Valley show the greatest disturbance of the strata, fold after fold occurring in rapid succession, with oil fields developed along several of the anticlinal axes.

The United States Geological Survey has in the latter half of 1901 entered upon the examination and survey of the California oil fields. General topographic maps of many of the southern districts have already been prepared, and the geological survey, stratigraphic and structural is well under way.

### THE BRITISH COLUMBIA MINING INDUSTRY IN 1901.

By WM. M. BREWER.

From the standpoint of aggregate production in the Province from the placer and metalliferous, as well as the coal mines the progress during the year 1901 must be considered as satisfactory, because in nearly every mining district there has been an increase in production; but from the standpoint of development of new districts or the opening up of new properties in old districts, the progress has apparently not been as satisfactory as those interested would have desired.

Before considering the conditions in individual mining districts, the writer will call attention to some of the reasons advanced for alleged unsatisfactory conditions of the progress of the mining industry during 1901. The smelter trust in the United States is blamed by the silver-lead miners for their troubles, but the bonus offered by the Dominion Government for refining lead has not been taken advantage of.

During the past year there has been considerable discussion in the columns of the public press as well as through a memorial sent to the Lieutenant-Governor in Council as to the alleged causes for the depression. Adverse legislation, unpopular taxation and labor troubles are considered the prime causes by many of the mining operators, while over-capitalization, mismanagement, and failure to pay dividends have been ad-

vanced as the reason by friends of the Government, by labor leaders and some of the editors. In the opinion of the writer, both sides to the discussion are correct to a certain extent, but at the same time, there are other causes which none of the disputants have brought forward; these are:—

First:—The purchase prices paid for mineral claims by English and Eastern Canadian companies have almost invariably been from 50 to 400 per cent greater than should have been paid.

Second:—Lack of conservatism by examining experts in measuring and valuing ore in sight.

Third:—Unrest amongst the laboring classes, caused by agitation provoked by so-called labor champions amongst the politicians and walking delegates of the labor unions.

Fourth:—The fact that extensive areas of mineral bearing lands are tied up by being held by men who have either not sufficient confidence in their own country, or sufficient enterprise, or who lack the capital to develop their numerous mineral claims, but yet place such an exorbitant value on undeveloped prospects that no experienced, conservative operator can consider a proposition to purchase. These mineral lands return comparatively no revenue to the Province.

Fifth:—The fact that the Province is passing through the same experience as have all older mining communities, and which may be designated as the period of "teething in infancy," or that period when heavy conservative operators await the results demonstrated by developments, and the opportunity to acquire properties at their actual value, instead of at the speculative values which have been paid by less experienced and more optimistic operators.

Different reasons exist in different districts, for example—the prime cause in the Atlin District has been litigation; in the Similkameen District, lack of railroad transportation; on the coast, lack of development, and prohibitive prices asked for prospects with possibilities.

Vancouver and Texada Islands and the Boundary Creek districts stand forth as examples where satisfactory progress has been the order of the day.

During the past year, the writer has personally visited the following districts, and is able to write from personal knowledge:—Rossland, Boundary, Lillooet, Kamloops, Camp McKinney, Atlin, Vancouver and Texada Islands, and the coast as well as White Horse in the Yukon and southeastern Alaska.

In the following review of individual districts the writer will follow the Minister of Mines' Report so far as the order in which each district will be considered.

**Cariboo District.**—The production from this district, which embraces the area forming the watershed of the Upper Fraser and Quesnel rivers, is confined to placer gold won from deep digging by hydraulic mining. The principal operator, the Consolidated Cariboo Hydraulic Company, which took out about \$350,000.00 in 1900, shows a product for 1901 of only about \$150,000.00.

The principal reason given for this great decrease in yield is shortage of water and consequent shutting down fully thirty days in advance of previous years. Of the operations of the district, but little information can be gleaned. Several hydraulic companies own leases, and work more or less systematically each year, but the results have never been reported as absolutely satisfactory. The shortage of water during 1901, must of course, have seriously affected all the operators. When the season opened it was generally expected that 1901 would prove a record breaker for old Cariboo, and also determine the value of several hydraulic leases on which plants had been in process of installation during previous years. But another season's work must be performed in order to establish material facts regarding values.

Late in the autumn word was brought out relative to a newly discovered placer field on Horsefly Creek, southerly from Quesnel Lake. Snow prevented any thorough prospecting as to richness or extent of the new diggings. All the reports concur in the main features regarding the strike, and apparently there is sufficient reliable information at hand to warrant a stampede in the coming spring.

**Omineca District.**—The transportation facilities have not been improved during the past year, so that this district which embraces the watersheds of the Peace, Parsnip and Findlay rivers is not any more easy of access than in previous years, and because of its remoteness most of its area still remains a *terra incognita* to the white man. It was confidently expected that the past season would have fully determined the value of much of the ground held by the Arctic Slope Company, as the installation of the hydraulic plant had been completed during the previous season; however, on the return of the manager and force to Victoria in the fall, it was ascertained that the clean-up did not meet expectations being only about \$5,000. The failure is attributed to friction between the manager and superintendent.

Of the other companies the 43rd Mining and Milling Company of Cariboo and the Saint Anthony Company of Santa Barbara, Cal., have been operating, but little can be learned as to the results of their operations, or the condition of their plants because they are still engaged in prospecting the ground embraced within their leases.

Little is known of the vast areas included within the boundaries of the Omineca District, and although a number of prospectors travelled through the district in 1898-99 there is but little reliable information which can be added to that gathered by the pioneers in the sixties.

**Cassiar District.**—This is by far the most extensive mining district in British Columbia, and promises within the next few years to rank amongst the most thoroughly prospected, at least of the northern districts. It embraces all the country east and west from the Eastern boundary of British Columbia to the International Boundary on the coast, and north and south from the 57th to the 60th parallels of longitude and includes Lake Bennett, Atlin, Teslin Lake, Stikine and Liard Mining divisions.

Of the latter practically nothing is known except by the Cassiar Central Railway Company, but of the other divisions a great deal has been learned since the discovery of the Atlin diggings in the autumn of 1898.

The yield from Atlin according to the quantity of gold on which the Provincial tax was paid during 1901, was only 12,120 ounces, as against 12,490 for 1900. According to the Gold Commissioner's report the yield by creeks during 1901 was as follows: Pine and Willow, 5,330 ounces; Spruce, 2,308 ounces; Boulder, 2,640 ounces; McKee, 1,103 ounces; Wright, 213 ounces; Graham, 103 ounces; Otter, 143 ounces; Gold Run, 31 ounces; Birch, 270 ounces; total, 12,120. But when it is taken into consideration that during 1900 the banks purchased \$750,000 in gold dust, and that only 370 ounces more than in 1901 were returned as the total output, it can readily be seen that the figures furnished by the Gold Commissioner are valueless so far as showing the actual production of the camp. It is almost certain that less gold was produced during 1901 than the previous year, because a considerable proportion of the best ground was worked by placer miners previous to last season, and the bulk of the gold mined during 1901 was the yield from hydraulic plants.

If litigation is avoided, and a strong, thoroughly capable man appointed gold commissioner, Atlin would prove a good camp for several years to come, provided of course, the gold bearing area is found to cover a greater extent of country, and the quartz veins, of which there have been several already discovered, maintain grade and continuity

with depth. More thorough exploitation and proper development of lode claims are absolutely necessary before any reliable opinion as to the life of this northern camp is warranted. The unknown areas are immense as compared with the known.

Of the water sheds of the Stikine River there is comparatively little known, beyond the knowledge gained by the pioneers of the sixties, when placer gold was discovered on Dease Lake and Thibert and McDame creeks, which are now included in the Liard Mining Division.

It was supposed that the granting of the charter and land grant in 1897 to the Cassiar Central Railway would be followed by a stampede and that large exploring parties would be sent in by the railway company. But exploitation has been on a very limited scale. A party sent in during 1898 by the railway company, apparently reported unsatisfactory results, and since that year the only progress which appears to have been made by the company has been limited hydraulic operations (the results of which are kept secret though it is claimed they are perfectly satisfactory), and some shallow development work on lode claims situated on McDame Creek within the Liard Mining Division. From the samples taken from these lode claims and assayed by the company, it would appear that high-grade copper and silver-lead ores occur, but whether in sufficient quantity to warrant mining in such a remote section and where the seasons are so short, is a problem that needs solution.

**Skeena River Mining Division.**—In this division are included the water sheds of the Skeena and Naas rivers as well as Queen Charlotte, Princess Royal, Banks and other islands bordering the coast north of Millbank Sound. There has been more activity in this division in developing lode mines during 1901 than in previous years. Development and prospecting work has been done on copper prospects on Observatory Inlet, to the north from the mouth of the Naas, also on the Skeena River, and on Princess Royal Island, while considerable prospecting has been done on Banks Island. Nothing of moment has been done on the Queen Charlotte group of islands.

The territory within the boundaries of the Skeena River Division has been imperfectly prospected and the work done so far, is merely of sufficient extent to incite a greater number of prospectors to go into the territory during the coming year to explore more thoroughly and systematically.

Some sample shipments of iron pyrites ore have been made from a proposition on the Skeena River to the Chemical Works at Victoria. This ore has been successfully treated for its sulphur content in the manufacture of sulphuric acid, and if the market on the Pacific Coast is sufficiently large for this class of ore, a profitable industry will be established as transportation is by steamer the entire distance.

The George Gould Syndicate has been carrying on prospecting work chiefly with a diamond drill during the past season on a group of mineral claims on the Skeena River.

This mining division promises to be the scene of some stampedes during 1902. It is more easy of access than much of the more northern territory, and the seasons, especially on the islands and near the coast, permit work to be carried on the year through, the only discomfort being the heavy rainfall during the fall and winter.

#### SOUTHEAST KOOTENAY DISTRICT.

**Fort Steele Mining Division.**—This mining division is rapidly becoming one of the most prosperous in the entire Province, owing chiefly to the fact that the Crow's Nest Pass coal-fields are within its boundaries, as well as the North Star and St. Eugene silver-lead mines. The construction of the Crow's Nest branch of the Canadian Pacific Railway in 1900 insured the future of the Fort Steele Division. Previous to the discovery



of coal some years ago, this territory had been only known in a general way as a producer of some placer gold mined in Wild Horse Creek.

The discovery of gold was followed by the discovery of copper-gold and silver-lead ores in 1897-98, and after the completion of the railroad the mine owners pushed development work on an extensive scale and with such satisfactory results that during 1901 the North Star Mine has paid \$135,500 in dividends, while the St. Eugene has paid \$210,000 during the same period.

The Crow's Nest Pass coal-fields are producing between 1,500 and 2,000 tons per day. These collieries were brought into special prominence early in 1901 because of the circulation of a report that James J. Hill had purchased the controlling interest and proposed diverting the product from British Columbia to the States, in order to hamper the smelting industry in British Columbia. While it was true that Mr. Hill had purchased an interest and proposed building a railroad to connect the collieries with the Great Northern Railway in Washington, it was perfectly apparent that the idea of diverting the product from British Columbia was an invention circulated to influence legislation against granting a charter for constructing the branch line of railway. However, the story was discredited, the charter granted, and the railroad is in course of construction. Undoubtedly during 1902 evidence of the prosperity and progress which will follow this improvement will become apparent, and unless some greater difficulties than at present are expected, present themselves, the Fort Steele Mining Division will in future rank amongst the most prosperous and progressive in the Province.

**Northwest Kootenay District.**—This district includes the territory north from the head waters of the Columbia River to the Big Bend of the Columbia. It is divided into two divisions, the Windermere and Golden. The mineral resources of the former, so far as at present known, are more valuable and important than those of the latter, but inaccessibility is retarding the progress of both divisions, for although the Canadian Pacific Railway crosses the Golden Mining Division from the east to west, the country to the north contiguous to the Columbia River is not easy of access. To the south, the Columbia River is navigable for about six months during the year, rendering travel to its head easy, but the mineral bearing zones are situated from 20 to 40 miles back from and to the west of the river. The connections between the mines and river transportation are being improved by the Government by the building of wagon roads.

A large number of mineral claims have been located in both divisions of this district, and each year assessment work has been recorded on many, while others have been re-staked and in some isolated cases quite extensive development work has been performed, notably on the Delphine, Red Line, Pretty Girl and Paradise properties in the Windermere Division.

The ores are chiefly silver-lead, carrying high values, but copper-gold ores have also been discovered, though high freight and treatment charges have hindered shipments from the latter. Several sample shipments of galena ore have been made, and have yielded satisfactory results.

Cheap transportation from the mines to the smelters is needed to ensure the growth and prosperity of the district; this should be by connection with the Crow's Nest Branch to the south rather than with the Central Pacific Railroad main line to the north. The certainty of such a connection would create an incentive for mine owners to develop more extensively and thus determine the value of their holdings. Until such connection is assured, the district of North East Kootenay will remain in its present unsatisfactory condition.

Some years back a smelter was built at Golden in order to secure a bonus, but has never been in blast and in all probability never will be fired

up because its location at a considerable distance from ore, fuel and fluxes, prohibits its being operated successfully.

**Northwest Kootenay District.**—From the Lardeau portion of this district have come excellent reports as to progress, but from the other mining divisions Revelstoke, Illecillewaet and Trout Lake the reports have been vague and unsatisfactory.

It is about 18 months since any of the Lardeau mines had reached such a stage of development that shipments of the high grade ore could be made by rawhiding or packing from the mines to the Arrow Lake, thence by steamer to Trail. During that time 3,110 tons of ore, valued at about \$450,000, have been shipped. The bulk of this has come from the Silver Cup, credited with an output of about \$180,000, the Nettie L. with \$146,000, and the Triune with \$82,000.

Talk of railway connection for both the Lardeau and Trout Lake Mining Divisions has been freely indulged in, and some surveys made, but apparently the railway company is waiting to see the results of development at depth, and the mine owners are waiting for the construction of the railway, and an influx of capital to purchase before many of them attempt to develop to any extent.

**Slocan District.**—This is the oldest, as well as the principal silver-lead production district in the Province. During the past three years though, the total yield has each year fallen short from that produced during either 1897 or 1898. From the returns for the first eleven months of 1901, it appears as though the total yield during that year will about equal the yield for 1900, which was 25,520 tons according to the latest report of the Minister of Mines. Although nearly fifty mines in the district have made shipments during the year, several of these are credited with less than 50 tons each, and only nine have produced more than 1,000 tons each, the Arlington heading the list.

The dividends paid by Slocan mines during the past year are as follows: Bosun, \$12,500; Payne, \$78,000.

Of course there is no doubt but that the low price of lead, coupled with the difficulty of selling ore to United States smelters, has been to a great extent responsible for the comparatively low production, but it must also be remembered that in many of the Slocan mines there is, on account of faulting and other irregularities in their structure, a considerable difficulty in following the ore bodies at times. The district produces some very high-grade ore, but the lower grade will not stand shipment and treatment at present prices of lead.

Some agitation has been occasioned through a desire by the mine owners for a local refinery, and the Dominion Government has offered a bonus, but up to date no smelter company has availed itself of the offer, although various newspaper reports have been sent out to the effect that such an establishment would be built.

**Nelson District.**—This district has gained prominence through the operations of the Ymir, Silver King, Athabasca, Mollie Gibson and the Yellowstone mines. Of these, the Ymir has paid out \$192,000 in dividends during the year.

The local smelter operated by the Hall Mining and Smelting Company has been running chiefly on custom ore, but during October about 13,000 tons were smelted from the Silver King Mine, owned by the same company. This yielded an average of 37.78 ounces silver and 6.50 per cent copper per ton.

The Ymir Mine is a free milling proposition, and has the enviable record of being the most successful in the Province. The mill is equipped with 80 stamps of 850 pounds each, and has Frue vanners for concentrating the tailings. About two-thirds of the values are saved by amalgamation, the remainder being held in the concentrates.

An important feature of this mining district is the location within its boundaries of the Bonning-

ton Falls water power, which has been developed to supply electrical power to the various mines in Rossland and smelters at Nelson and Trail.

Development work of a more or less extensive nature has been performed on a number of mineral claims located in the district which includes, as well as the Nelson Division, the Goat River and Ainsworth divisions, but no phenomenal strikes have been reported from any of these. The district is large, and should in the future become more prominent than in the past, especially when it is considered that it is not dependent entirely on one character of ore, as some of the other districts are.

**Rossland District.**—Although the number of dividend paying mines has been less than in the Slocan District, this has always been considered the banner district in the Province because of the extensive ore bodies of the Le Roi, War Eagle, Center Star, Iron Mask and Josie mines. The dividend paid from this district during 1901 are as follows: Center Star, \$105,000; Le Roi No. 2 (Josie) \$144,000.

Because of the labor troubles and changes in the management of the Le Roi Mine, this district has been more prominently before the public during 1901 than almost any other on the American continent.

The writer has always held the opinion that the purchase prices paid for many of the mines in the district and especially the Le Roi and other acquisitions by the British-American Corporation were far in excess of the value of the properties, and this opinion is intensified since the publication of the report on the Le Roi by Mr. Frecheville. To this cause, as well as the labor agitation, may be attributed much of the trouble which has prevailed during the past two years. The shareholders failed to understand why no dividends were forthcoming, while the management could not pay dividends from low-grade ore, keep development work well ahead, equip the mines with new machinery, and at the same time, because of the passage of the eight hour law, be confronted with greater cost for labor, or a fight with the Miners' Union. That such conditions should prevail is particularly unfortunate, especially in a new mining country where the greatest need is capital, in order to secure which, it is necessary that the public should feel absolute confidence. From the latest figures representing the output for the past year, it is probable that there will be a slight increase over that of 1900, which was reported by the Minister of Mines at 217,636 tons, but in consideration of the vast outlays for additional mining machinery, hoisting plants, etc., at the principal mines this showing is far from satisfactory.

Really the only satisfactory feature in the conditions around the Rossland Camp is the decrease in cost, which has been brought down to the point where \$9.00 per ton will pay all costs of mining, freight and treatment at the leading mines.

The future of Rossland depends on a policy of the most conservative character to be pursued by the managers, as well as employees, the abandonment of all radical measures, and a united effort to secure the confidence of the public.

The smelting industry in this district as represented by the Trail Smelter, has progressed more satisfactorily than the mining, notwithstanding the additional smelter capacity established in the Boundary. Rumor has said that the management of the Trail Smelter contemplated the addition of a lead refinery plant, and the silver-lead mine owners have had conferences with the manager of the smelter on the subject, but no authoritative statement of such a purpose has been yet made by the smelting company.

**Boundary Creek District.**—The shipments from the copper mines from this district during 1901, will almost, if not quite, reach 500,000 tons. For a district which has only been afforded railway transportation for about two years, this is certainly a remarkable showing. Practically, all of

this ore has been smelted at Grand Forks and Greenwood.

Although the latter smelter was only blown in February 18, 1901, it is expected that the second furnace, which will double the smelting capacity, will be blown in early in the present year. The daily capacity of the Granby Smelter at Grand Forks has been increased from 600 tons to about 1,300 tons, and a converter plant is also being installed in order to ship blister copper instead of matte. This company is contemplating also a further addition to the smelter capacity.

The ore bodies in the leading mines, the old Ironsides Knob Hill, Mother Lode and B. C. are very extensive and have been systematically and thoroughly developed. The general grade of the ore, though, is low, and it is of vital importance to the district that the price of copper remain firm.

Ten mines have been shipping during the past year, but development work has been prosecuted vigorously on several others.

The completion of railway connection between Grand Forks and the Republic Camp in Washington, is anticipated with great interest, as ore from the latter will be brought to the Granby Smelter for treatment as such a reasonable cost for freight as has been impossible in the past. During the winter of 1900-'01, considerable ore was hauled by sleighs, but the cost was too high to continue the policy during the summer.

Active operations in railway building have added to the prosperity of the Boundary during 1901, and with favorable conditions prevailing with regard to the price of copper this district ought to become one of the most prosperous in the Province, at the same time any material reduction in the price of copper will be more seriously felt in this district than in any other, because, unlike the Rossland ores, the gold values carried by the ores are very low. It is essentially a copper producer on an extensive scale from low-grade ores without having had the advantage enjoyed by the Montana and other copper producing camps of high-grade surface ores to offset the leaner ores occurring at depth.

There are, however, natural advantages enjoyed by the Boundary operators, such as excellent water powers, self-fluxing ores requiring no roasting or calcining, and such extensive deposits as to minimize the cost of mining, which to a great extent offset the low grade of the ores, and enable profitable operations to be conducted under conditions which would result in absolute loss in less favored districts.

The western portion of the Boundary Creek district known as Osoyoos Mining Division, contains occurrences of free-milling quartz which were amongst the earliest discoveries of lode mines in the Province. The most important of these is the Cariboo-Camp McKinney, which has paid \$459,337 in dividends, the last payment having been made in October, 1900. The progress in Camp McKinney during the past year has not been satisfactory, for in addition to the suspension of dividends by the Cariboo-Camp McKinney mines, there has also been a suspension of operations on adjacent properties such as the Waterloo, Fontenoy, Sailor, Minnehaha and others. Apparently the future of the camp depends entirely on the Cariboo-Camp McKinney, and if a resumption of dividends occurs, renewed confidence will be felt in the camp; otherwise, it looks as though its days were numbered.

Fairview Camp is another free-milling ore producer in the Osoyoos Division. This has had a checkered career. The main operator, the Fairview Corporation, closed down in 1900 owing to lack of funds, but procuring assistance from the Gooderham, Blackstock, Syndicate of Toronto, succeeded in extending development and recently organized on an assessable plan. It is too soon to pass an opinion on the results of the re-organization, but the prosperity of the camp may be said to hinge on these results.

Twenty Mile Camp is also included in the Osoyoos Division. This has been brought into some prominence through the operations which have been carried on since 1898 on the Nickel Plate Mine purchased by M. K. Rogers as representative for the late Marcus Daly. The ore is an arsenical iron, carrying high gold values. Remoteness from railway transportation has retarded the progress of the camp, notwithstanding that the development has been carried on continuously at the Nickel Plate. The owners of the other mineral locations keep up their assessment work, but no permanent prosperity can be assured until railway facilities are extended, and an opportunity afforded for shipping ore.

#### VERNON DISTRICT

This district occupies the territory drained by the Okanagan Lake, which is about 120 miles in length, and bears the same relationship to the Okanagan River as the Windermere Lake does to the Columbia, viz.:—its source. Apparently the desirable and fertile land of the valleys has attracted agriculturalists and horticulturalists more strongly than the prospects for mineral in the mountains have encouraged prospectors.

Comparatively few mineral claims have been staked, and on those the owners have performed very little work. While some free-milling ore has been discovered in the mountains known as the Gold Range, easterly from the head of the Lake, it appears from such information as can be obtained, that the majority of the occurrences are either refractory gold ores or else copper gold with some deposits of silver-lead.

#### YALE DISTRICT

In this is included all the territory traversed by the Canadian Pacific Railway from Hope, about 70 miles east from Vancouver, to a point a few miles west from Revelstoke, on the Columbia River, as well as the territory to the south of the railway which forms the water sheds of the Nicola, Tulameene and Similkameen rivers with their tributaries.

The northern portion of the district may be described as the territory forming the water sheds of a portion of the Fraser and the Thompson rivers with several of their tributaries included. Since the days of placer mining on these streams, the district, though quite extensive in area, has not progressed as rapidly as might have been expected, although in several portions good prospects, chiefly of copper-gold ores, have been discovered.

The southern portion, known as the Similkameen Division, has been prospected quite extensively, but the growth and prosperity are retarded because of lack of transportation facilities. It was considered almost certain that the Coast Kootenay Railway which will eventually traverse this portion of the district would have been under construction during 1901, but although the Provincial Government proposed to subsidize such a railroad during the last session of the Legislature the lobbyists for rival claimants failed to convince the Government as to which company the aid should be extended. The Canadian Pacific and the Vancouver, Victoria & Eastern railways were the two companies lobbying relative to the merits of their respective routes. The result was a proposition made by the Government, to the terms of which no company appeared willing to accede, and in consequence this portion of the Province still remains inaccessible, and during 1901 but very little work of any description has been done. The Government sent a survey party to search out a feasible route across the Hope Mountains, and surveys have been made from the main line of the Canadian Pacific Railway, at Spence's Bridge, near the confluence of the Thompson and Nicola rivers, up the Nicola River to the Nicola Lake, thence south to the Similkameen, near the confluence of that river and the Tulameen.

Discoveries of coal have been made in the Nicola, Tulameen and Similkameen valleys. Extensive bodies of copper ores have also been noted, but these are of such low grade that they can never be utilized until railroad facilities are extended, and a perfect

system of branch lines built to facilitate the transportation of ore, fuel, fluxes and supplies. The territory is one of the most promising in the Province and in past years has been a large producer of placer gold and platinum.

In the northern portion of the district around the town of Kamloops, considerable activity has prevailed, and from all appearances the British Columbia Exploring Syndicate, Limited, has developed a mine known as the Iron Mask. One of the latest reports from Capt. J. Argall, the superintendent, to the shareholders in England, is as follows: "The large lode 40 feet wide to the hanging wall shows up very fine and will average fully 6 per cent copper throughout, with fair values in gold and silver. We have sold up to date approximately \$2,000 worth of ore."

This mine has been in course of development about eighteen months by the present owners, and has only been making some sample shipments.

No important developments have followed other work in the neighborhood, and although a good deal of excitement was occasioned some years back by the discovery of cinnabar, that property has remained idle since 1897.

Dredge mining has been carried on during the past year on the Fraser River near Lytton, also on the North Thompson near Kamloops, but the work has been more of a prospecting character and considerable time has been occupied in perfecting the plants, which are dipper dredges built on the New Zealand plan. Satisfactory results have been obtained from the preliminary work, and by the close of 1902, the value of dredge leases should be determined.

Heretofore, this method of mining has not been entirely satisfactory, but the inadaptability of plants has been the main cause. There appears no question but that gold in sufficient quantities is hidden in the beds of several streams in the Province, but nearly every attempt to save it and prosecute operations profitably has failed. The management of the dredges now in operation are practical New Zealand miners, thoroughly experienced in that method of mining.

#### LILLOUET DISTRICT

This district is essentially a free-milling camp. Little progress has been made during the past year. Inaccessibility and excessive cost for freighting, have been very largely responsible, but the work performed by the Government during the fall months in improving the trails, should in future, remove to a great extent these causes.

While the high grade surface ores were being treated high cost did not retard progress so much as has been the case during 1901, when the ores commenced to show decreases in value in free gold per ton as deeper levels were reached in the mines. The excessive purchase prices demanded for undeveloped prospects, have added to the causes for unsatisfactory progress. Mismanagement, added to superintendence by inexperienced men, has been the rule rather than the exception.

The Cadwallader Creek mines which produced \$51,558.00 in gold saved by amalgamation during 1900, have been idle many months during 1901. The Bend 'Or Group, the producer of about \$40,000 in 1900, has been idle, except about two months, owing to lack of working capital, and necessity of carrying on development to open the ore body at a lower level.

The Lorne and Woodchuck groups, which were bonded late in 1900, and on which some \$50,000 were expended in development and erection of a five-stamp mill, have reverted to their original owners, the cause assigned being, that the purchase price agreed upon was based on ore carrying \$40 per ton, but depth demonstrated that the value decreased to about \$10 per ton.

In fact the camp may be considered now a low-grade camp, and although the ore bodies are fissure veins, very persistent, easy to mine, and carrying about 70 per cent of their values as free gold, even this grade of ore will not stand 6c. and 7c. per lb., freight charges for a 70-mile haul, nor will mills



with limited crushing capacity treat sufficient low-grade ore to justify operations.

One very unfortunate failure has to be recorded from Cayoosh Creek near the town of Lillooet. It is that of the Toronto & Lillooet Reefs Company, which expended over \$100,000 in machinery, aerial tramway, etc., without developing the mineral claims which were relied on to furnish ore, or indeed even testing the ore to determine its character. The failure was due entirely to lack of conservatism, and a display of very poor judgment by the examining expert, followed by gross mismanagement.

COAST AND VANCOUVER ISLAND

The mining districts included under this head are New Westminster, Victoria, Nanaimo, Alberni and West Coast of Vancouver Island.

The progress throughout this territory generally has been quite pronounced during 1901. It is a remarkable fact that in every instance where thorough and systematic development work has been done the results have been the development of a mine carrying comparatively high grade copper-gold ores in quite extensive bodies. It is true such work has only been carried on at the Three Jays, Tye and Monitor on Vancouver Island, on the Copper Queen, Cornell and Marble Bay on Texada Island, and on the Britannia at Howe Sound, and the property of the British Columbia Exploring Syndicate on Frederic Arm on the Coast.

Besides these, prospecting work on the Loyal and Prescott on Texada Island, on the Sarita, Lake Shore, Anaconda, Indian Chief, Copper Canyon, Golden Eagle, Thistle and on the Iron Ore mines on Vancouver Island has resulted satisfactorily.

This portion of the Province in which there was not a single shipping mine as late as 1899, has leaped to the front during the past two years. The exceptionally favorable conditions with regard to ocean transportation, high grade ores, cheap mining, accessibility of all fluxes and fuel are making their influence felt, and the opinion expressed by the writer four years ago, that this section of the Province would show good progress is being verified.

The list of shipping mines will be increased at once, by shipments being commenced at the rate of 100 tons per day from the Three Jays, where the aerial tramway, bunkers, etc., have just been completed, and the steamer *Manuense* chartered to carry 3,000 tons per month between the mines on Alberni Canal and the Tacoma Smelter.

During 1902 two smelters will be erected on the east coast of Vancouver Island, one at Osborne Bay by Messrs. Breen, Bellinger and Fotheringham, of Montana, the other at Ladysmith, only a few miles distant, by the Tye Copper Company, of Mt. Sicker. There is no doubt but that under present conditions one of these smelter plants will be sufficient to supply the demand of the island, but the managers are looking towards the northern portion of British Columbia, the Yukon, and southeastern Alaska to furnish sufficient ore to make up any deficiency. The cost of smelting can be reduced to a low figure at either of these points, and with thoroughly modern plants competition by the United States smelters can be successfully met.

On Texada Island the Van Anda copper properties have been bonded and partially paid for by the North West Company. The smelter is again in blast; heavier mining machinery has been installed at both the Copper Queen and Cornell mines, while deeper and more extensive development work has exposed additional ore reserves.

It is gratifying to have to record that on the Marble Bay, as well as on the Van Anda mines, the ore maintains its high grade gold values at the lowest levels and bornite ore forms the bulk of the product.

On the coast active operations have been confined to the Howe Sound and Frederic Arm camps. Some disappointment has been felt that more extensive operations have not yet been commenced on the Britannia Group, but the Montana men who now hold the control do not propose to run any chances

of failure in operating this property. The grade of the ore considered with the extent of the bodies demands an enormous output, and consequently a proportionate outlay for plant; therefore previous to equipping this group of mineral claims it is very advisable that every question bearing on success or failure should be very carefully considered.

The territory surrounding these properties has been pretty thoroughly prospected during 1901, and several other groups have been developed to a greater or less extent. Some sales of prospects have been consummated, and taking all the circumstances into consideration, the progress at Howe Sound may be considered satisfactory.

At Frederic Arm, the British Columbia Exploring Syndicate has, after expending a considerable amount of money, placed its property in an encouraging condition. The ore body which occurs down to the No. 3 tunnel has been found to maintain continuity to a greater depth, though it was not struck in the No. 4 tunnel, but was encountered in the upraise at 92 feet, or 67 feet below the No. 3 tunnel. At that point one of the freaks which are not seldom met with in the structural geology in several portions of the Province, has manifested itself, and a horizontal fault has changed the dip to almost flat.

Prospectors have not been as numerous as during the seasons of 1899-1900, chiefly because so few deals have been made during the past year. The establishment of local smelters will undoubtedly prove an incentive for more thorough development next year, and the writer is of opinion that the value of several of the Coast properties will be determined within the next twelve months.

Coal mining on Vancouver Island has been beset with a good many difficulties during 1901. The discovery and use for fuel of crude oil in California has necessarily diminished the exports, and when to this are added some labor trouble with the Dunsuir collieries and the disastrous fire during the summer at the Extension Mine, which has caused it to be closed down since, it is not surprising that the progress has not been as satisfactory as during some previous years. However, the building of local smelters which will draw their fuel supply from the Vancouver Island collieries ought, with favorable conditions in other directions, to result in a largely increased output during 1902. The total tonnage exported for the first ten months of the past year reached 689,007 tons, as against 906,205 tons exported in 1900. The total for the entire year during 1901 will probably reach 800,000 tons, while the quantity consumed in other portions of Canada, for coke, and at the collieries will probably be about the same as during 1900, viz.:—486,832 tons.

Iron ore mining on Texada Island and the West Coast of Vancouver Island has assumed larger proportions during 1901 than for any previous year. The Swaney Syndicate which has been working since 1899 to obtain control of the immense deposits of magnetite on these coasts, has, since January, 1901, commenced work in earnest at the Sarita River, Sechart and Copper Island, near the entrance to Barclay Sound on the west coast of Vancouver Island, as well as at the old iron mines on the west coast of Texada Island. From the latter regular shipments have been made for some months to Irondale Furnace near Port Townsend in Washington, and tramways, etc., are in course of erection at the Sarita River to enable the operators to ship from there at an early date.

All of these deposits of iron ore, as well as some quite extensive ones on the Gordon River, which empties into San Juan Harbor on the west coast of Vancouver Island, are high-grade magnetite, carrying over 60 per cent metallic iron, and quite low contents in silica, sulphur and phosphorus with no titanium, consequently there is no reason why the Pacific Coast should not eventually successfully compete with the Atlantic as an iron and steel producer.

The writer has suggested in the local press the advisability of the Government taking up the matter of inquiring into the demands of the markets of the Orient and compiling such statistics as will at a

glance demonstrate to capitalists the possibilities of those markets, and the desirability of establishing refining and manufacturing plants on the Pacific Coast in British Columbia to supply such trade. If such a policy could be carried out and it were demonstrated that the Oriental markets are as large consumers of iron, steel, copper, silver and lead as they are supposed to be, then the geographical position of the British Columbia coast ports would place that Province as a formidable competitor to other refining and manufacturing centres of the world. There are, of course, such factors as labor conditions, supply of ocean-going vessels, and home production of the crude materials to be taken into consideration.

WESTERN AUSTRALIA'S MINING INDUSTRIES.

By H. L. GEISSEL.

Australia, the fifth continent of the world, embraces an area of over 3,000,000 square miles, and of this vast territory one-third, or 975,920 square miles, is embraced within the boundaries of the colony of Western Australia. With a length from north to south of 1,480 miles, an extreme breadth from west to east of 1,000 miles, and a coast-line 5,200 miles in length, the area of Western Australia in acres reached a total of 620,588,800. Western Australia boasts the possession of great mineral wealth, gold, silver, copper, tin, lead, coal, and even gems being found.

In the introduction of his report for the year 1900, the Under Secretary for Mines of the colony of Western Australia says:

"In the year 1885, when gold was discovered in the Kimberley District, the exports of lead and copper-ore only amounted to 1.13 per cent of the total exports of Western Australia. At the end of the year 1900, the value of gold and other minerals exported was 56.85 per cent of the total value of the exports of the State. Since the discovery in 1885, gold to the value of \$109,286,820 has been produced, and it is not to be wondered at that the unearthing of this wealth has stimulated the prosperity of this State to a marvelous extent.

"In 1885 the population was 35,186; at the end of 1900 it was about 180,000. The revenue for the first named year was \$1,570,815, while for the latter it was \$14,528,624. During the same period the value of the imports increased from \$3,159,000 to \$28,965,600.

Such has been the effect of mineral discoveries on the progress of this State in the past, and, great as it has been, it can safely be predicted that the development of the wealth existing in its vast, partially-prospected mineral areas will do still more to add to its prosperity in the future."

There are now the following nineteen declared gold-fields in the colony:

	Area in square miles.
Kimberley .....	46,886
Pilbarra .....	34,880
West Pilbarra .....	9,480
Ashburton .....	6,992
Gascoyne .....	5,061
Peak Hill .....	12,194
Murchison .....	20,513
East Murchison .....	28,242
Yalgoo .....	18,921
Mount Margaret .....	42,154
Broad Arrow .....	590
North Coolgardie .....	30,609
Northeast Coolgardie .....	21,542
East Coolgardie .....	632
Coolgardie .....	11,974
Vilgarn .....	15,593
Dundas .....	17,848
Donnybrook .....	102
Phillips River .....	.....

This gives a grand total of no less than 324,213 square miles exclusive of the Phillips River mineral district, which was only recently proclaimed a gold-field.

The Kimberley gold-field is the largest of the colony's fields. It is situated in the extreme north-eastern corner of the State, its principal diggings and mines being in the broken country at the head of the Elvira and Mary rivers. The official center is Hall's Creek township, 212 miles inland from Windham, and 304 miles from Derby, on King's Sound. The field was discovered in 1882. The

principal mine in the field is the Ruby Queen, situated about seventeen miles from Hall's Creek, which has been continuously worked and developed for the last thirteen years.

The Pilbarra gold-field, covering an area of 34,880 square miles, is one of the oldest in the colony. It is divided into two districts, the Marble Bar and the Nullagine. The former yielded 10,508 ounces of gold during 1900, and the latter 4,492 ounces.

Immediately to the west of the Pilbarra gold-field lies the West Pilbarra field, proclaimed in September, 1895. In 1900, only 681 tons of ore were treated on the field, yielding 596 ounces of gold, or an average of 0.87 ounce per ton of ore treated.

The Ashburton gold-field was declared in December, 1890, but so far has only produced 5,237 ounces of gold. The field is said, however, to offer good inducements to well-equipped prospectors, as the various small belts of auriferous country have been but slightly prospected.

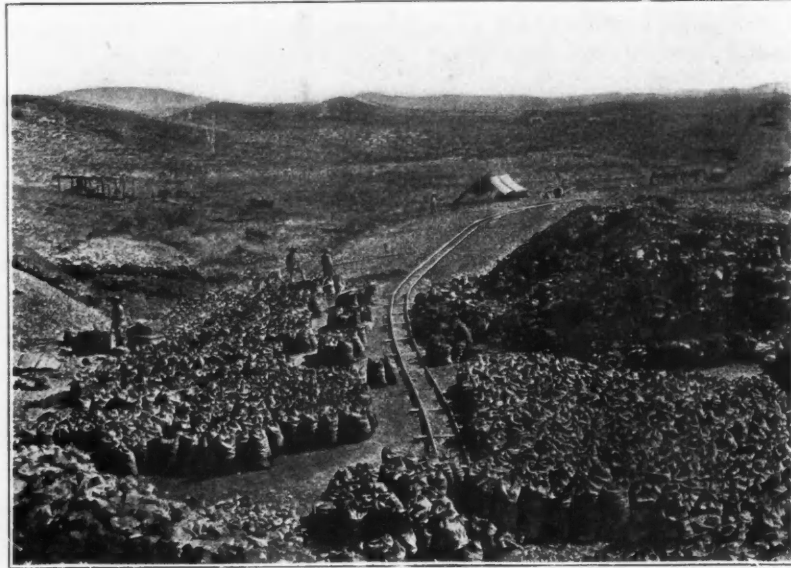
The Gascoyne gold-field lies adjoining and immediately to the south of the Ashburton. It dates its official existence from June, 1897, the principal center being Bangemall. Up to the end of the year 1900, the field had only produced 221 ounces of gold.

The Peak Hill gold-field has an area of 24,194 square miles, the chief center being the township of Peak Hill. The population is between 600 and 700 persons and is rapidly growing. The Peak Hill Gold Mines, Limited, employ over 200 men,

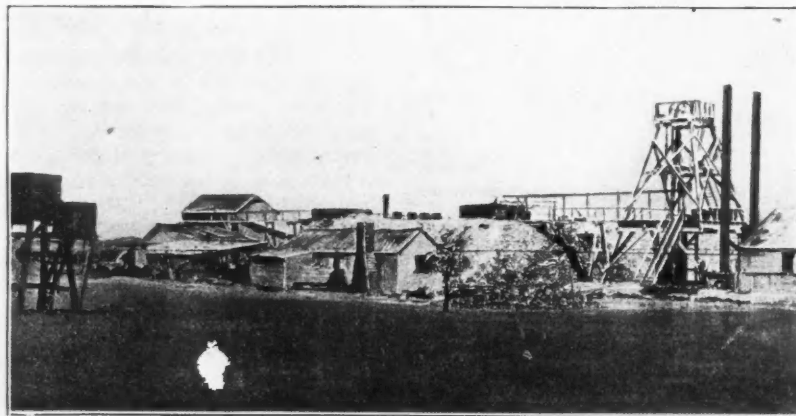
garet field is divided into the Mount Malcolm and the Mount Margaret districts. In the Mount Malcolm district 81,497 tons of ore were treated in 1900, yielding 92,068 ounces of gold, or an average of 1.12 ounces per ton. In the Mount Margaret district, 51,325 tons were treated, yielding 52,344 ounces, or 1.01 ounces per ton of ore treated.

ton, and the Englishman Cosmopolitan Proprietary Co., which obtained 14,002 ounces of gold during the same period.

The Northeast Coolgardie gold-field was proclaimed in February, 1896. It is divided into three districts, namely: Kanowna, Bulong and Kurnalpi. Kanowna is the chief town of the gold-field. A branch rail



WHIM WELL COPPER MINE, WEST PILBARRA GOLDFIELDS.



CHUMS CONSOLO, MT. MAGNET, PLAN T, MURCHISON GOLDFIELD.

and control the chief center of activity in the field.

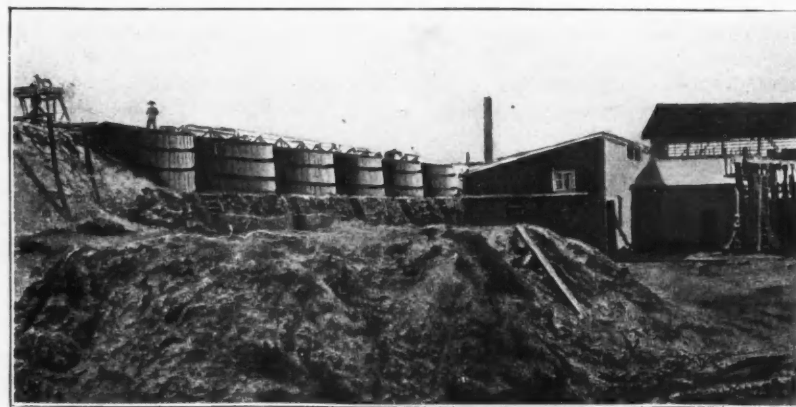
The Murchison field, with its 20,519 square miles of auriferous territory, is one of Australia's most valuable national assets. It is the best watered of all the fields, with the possible exception of Kimberley in the far north, fresh water existing everywhere at comparatively shallow depths. The field is divided into the four following districts, the production of which was as follows:

Cue district .....	19,811 ounces
Nannine district .....	27,335 "
Day Down district .....	14,504 "
Mount Magnet district .....	40,284 "

The East Murchison gold-field was declared in May, 1895. Its area is 28,242 square miles, and its chief center is Lawlers. During the year 1900, 56,923 tons of ore were treated; and the gold obtained therefrom amounted to 63,679 ounces, or an average extraction of 1.11 ounces per ton of ore treated.

The Yalgoo gold-field, which covers an area of 18,921 square miles, was proclaimed in February, 1895. The main mining operations are carried on in the southern part of the field, and the total yield in 1900 was 9,813 ounces of gold. Previous to 1900 the field had yielded 26,101 ounces.

The Mount Margaret gold-field, as a gold producer, comes second only to the East Coolgardie. Prior to April 1, 1897, it was included in the Coolgardie field. It has an area of 42,154 square miles. During 1900 the field made great progress. Many important discoveries were made, and its gold output attained considerable proportions. The field is blessed throughout with an abundant water supply, but, unfortunately, timber is very scarce, whether for mining purposes or for fuel. The Mount Mar-



WORKS AT THE NEW CHUM, MOUNT MAGNET, MURCHISON GOLDFIELDS.

The Broad Arrow gold field is one of the smallest fields in extent. It came to the front several years ago, and in 1899 there were 239 head of stamps on the field. During the year 1900 the output amounted to 50,695 ounces of gold.

The North Coolgardie gold-field, covering an area of 32,231 square miles, is divided into four districts—Menzies, Niagara, Yerilla and Ularring. The output of this field in 1898 was 72,879 ounces; in 1899, 116,968 ounces, and in 1900, 105,435 ounces. Among the principal mines in the North Coolgardie section are the Lady Shenton Gold Mining Co., Limited, which treated 16,340 tons of ore in 1900, yielding 20,479 ounces of gold, or a yield of 1.26 ounces per

divided into two districts, Coolgardie and Kunalaling. In the former are the following centers: Bonnievale, Bulla Bulling, Burbanks, Coolgardie, Gibraltar, Londonderry, Red Hill and Widgiemoultha. At Bonnievale, the Vale of Coolgardie is the principal mine. At Coolgardie itself, Bayley's United, Cosgrove's, the Golden Bar, King Solomon's and the Lady Loch mines are working with more or less success. The number of men employed in the field during 1900 was 2,694.

The East Coolgardie gold-field continues to occupy a position of unquestioned supremacy among the gold-fields of Australia. The area of the field is only 632 square miles, but its auriferous wealth probably



exceeds that of any other similar area in the world. The growth of the field has been phenomenal. In 1804 it was absolutely a wilderness. Now its population numbers 36,000, and the two towns within its confines—Kalgoorlie and Boulder City—are next to Perth and Fremantle, by far the most important cen-

Some of these surface deposits have proved to be highly auriferous in places.

The rocks of the field consist of talc, mica, hornblende and chloritic schists, intersected by dikes and masses of certain igneous rocks, the exact nature of which has not yet been determined. At the surface

these rocks have been decomposed into a more or less mottled clay. Mining operations have shown that this zone of alteration extends to various depths, fluctuating between 50 and 400 feet, which latter depth, however, is exceptional.

The production of the field for the year 1900 reached a total of 737,971 ounces. The average number of miners employed was 7,403 in 1900, as against 6,610 in the previous year.

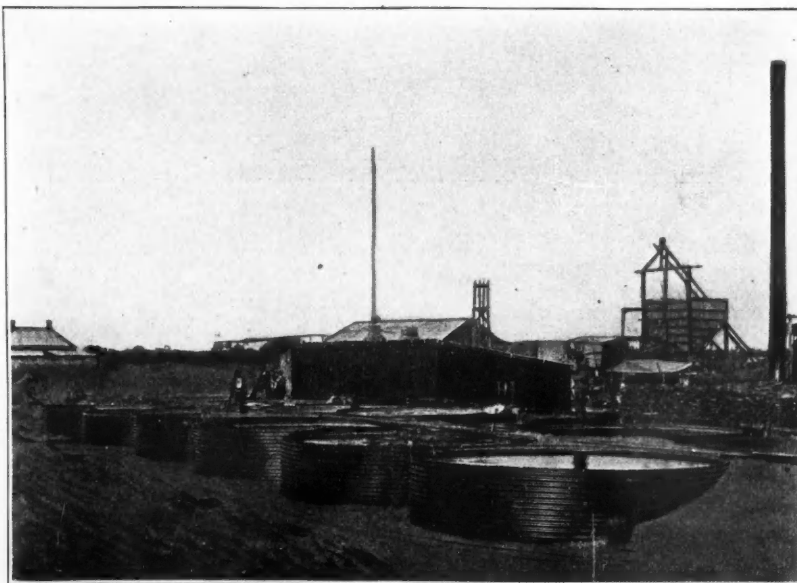
According to the annual report of the Department of Mines, the value of the mining machinery in 1900 in the Coolgardie gold-field amounted to \$5,239,080. The importation of powerful and valuable machinery was heavy last year. This has been due to the fact that the question of treating the enormous quantities of sulphide-ore that have been proved to exist can no longer be termed a troublesome one. In September, 1900, the announcement was made that the Diehl process, which had only been previously known in the field as existing in the laboratory stage, had obtained an extraction of 97.6 per cent of gold, at a cost of 18 shillings per ton, including crushing and treatment; a bulk test of 653 tons of sulphide ore at Hannan's Brown Hill gold mine obtained 95.7 per cent of gold. Another process that is claiming much attention is the Riecken process, which is claimed to extract 97 per cent of gold at a nominal cost.

The principal mining companies in the East Coolgardie gold-field are the Golden Horseshoe Estates, Limited, which, in 1900, treated 76,532 tons of ore, yielding 132,863 ounces of gold, or an average of 1.73 ounces per ton treated. The technical equipment



THE GLADSTONE TIN MINE, AN OPEN-FACE WORKING IN THE GREENBUSHES REGION.

ters of population on the western side of the Australian continent. Kalgoorlie is undoubtedly, at the present time, the most flourishing and prosperous town in the colony, and the short line of railway that connects it with Boulder City is one of the best, if not absolutely the best paying line in the whole of Australia. The principal topographical feature of the field consists of a low, broken range, of which Mt. Charlotte, 1,378 feet above the sea-level, forms the highest peak, which trends generally north-northwest from the head of Hannan's Lake. This line of comparatively low hills diminishes in altitude from Mount Charlotte to a mere ridge, which gradually merges into the flat ground surrounding the lake, and forms the main water-parting of the district. To the eastward the country extends in a wide, gently sloping valley, with a southerly fall, flanked by a line of low hills, some six or seven miles distant; to the westward is another valley of about two miles in width. By far the larger portion of the field is covered with a mantle of reddish, loamy soil, and other superficial accumulations of variable thickness. These superficial deposits consist of ironstone, gravels and cement, passing in certain isolated localities into practically pure brown hematite.



THE LANCEFIELD CYANIDING TANKS AT LAVERTON, IN THE MT. MARGARET GOLDFIELD.



THE TOWRANNA GOLD MINING COMPANY'S MILL AND MINE AT ROEBOURNE, WEST PILBARRA FIELDS.

of the plant of the Golden Horseshoe Estates Co. included 55 stamps, 20 leaching vats, of a capacity of 70 tons each, and 9 filter-presses.

The Great Boulder Proprietary Gold Mines, Limited, treated 54,887 tons of ore, yielding 115,909 ounces of gold, or 2.11 ounces per ton treated. The company has 40 stamps, 14 leaching vats and 15 filter-presses at work.

The Ivanhoe Gold Corporation, Limited, treated 74,750 tons of ore, yielding 107,052 ounces of gold, an average of 1.43 ounces per ton treated. The plant of the company included 61 stamps, 16 leaching vats, of a capacity of 80 tons each, and 4 filter-presses.

The Lake View Consols, Limited, treated 28,643 tons of ore, yielding 97,748 ounces of gold, an average of 3.44 ounces per ton treated. The plant included 51 stamps, 26 leaching vats and 16 filter-presses.

The Hannan's Brown Hill Gold Mining Company treated 69,795 tons of ore, yielding 80,207 ounces, or an extraction of 1.30 ounces per ton treated.

The Great Boulder Perseverance Gold Mining Company, Limited, treated 43,279 tons of ore, yielding 47,099 ounces, or a yield of 1.08 ounces per ton treated.

The Yilgarn gold-field no longer possesses the importance attached to it a few years ago, and this not by reason of any diminution in its intrinsic worth, but from the fact that as fresh mining centers were opened up and developed within its original boundaries it has been gradually shorn of its area, and is now confined to but a comparatively small portion of its auriferous acreage, as first declared in November, 1888.

The Dundas field was proclaimed in 1893, and embraces 17,848 square miles. It does not appear that Dundas will attain any prominence as an alluvial field, although as a reefing district its structural features are highly favorable. In 1900 the field yielded 40,882 ounces of gold. The total production of the field, previous to 1900 was 103,903 ounces.

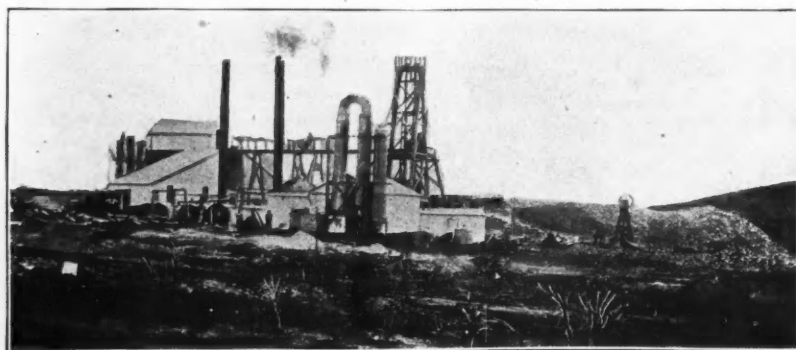
The Donnybrook gold-field, with an area of only 102 square miles, has only existed as a proclaimed gold-field since November, 1899. It is, however, the general belief that within a reasonable time Donnybrook will take a high place among the gold-producing districts of the colony.

It may be of interest to mention the value of

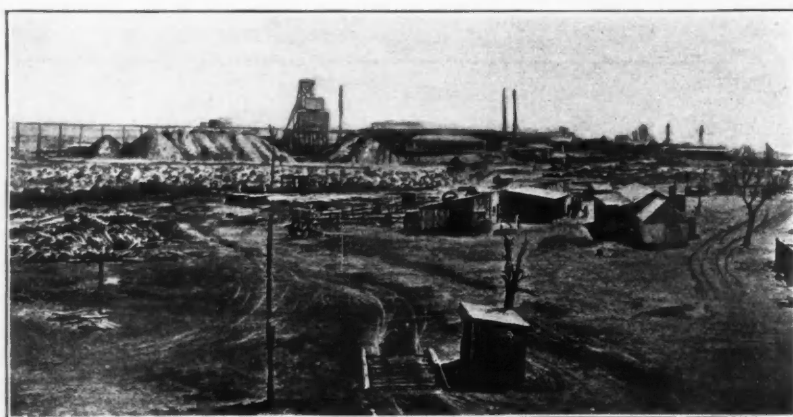
Bight, but not so far east as the Dundas field. This new district has hitherto officially borne the name of the Phillips River mineral district, but is locally known as Ravensthorpe, the name of the range among the mines which are situated. On September 21, 1900, it was proclaimed a gold-field.

The mines are situated at a considerable height above the sea, the principal leases in the district being the Floater Group, the Maori Queen Group, the Kingston Group, and others.

The development of the copper, lead and tin-mining industry is most satisfactory. In the north-



THE LADY LOCH MILL AND MINE, COOLGARDIE DISTRICT.



GENERAL VIEW, IVANHOE GOLD MINE, 1900, IN THE EAST COOLGARDIE DISTRICT.

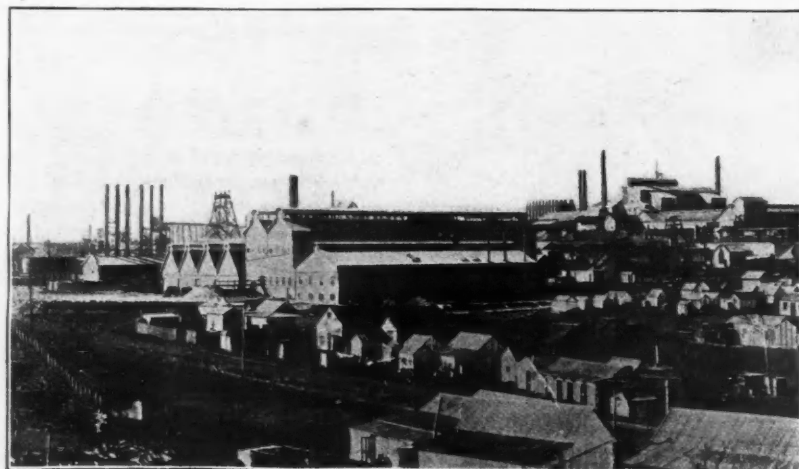
machinery installed on the leading gold-fields at the end of December, 1900. The values and locations are as follows:

East Coolgardie goldfield.....	\$5,243,372
Coolgardie goldfield.....	1,739,702
Mount Margaret goldfield.....	1,579,543
North Coolgardie goldfield.....	1,204,748
Murchison goldfield.....	1,192,165
Broad Arrow goldfield.....	777,976
Northeast Coolgardie goldfield.....	604,171
East Murchison goldfield.....	517,489
Dundas goldfield.....	422,461
Yilgarn goldfield.....	392,375
Pilbarra goldfield.....	177,878
Yalgoo goldfield.....	168,982
Peak Hill goldfield.....	157,128
West Pilbarra goldfield.....	62,650
Kimberley goldfield.....	40,392
Donnybrook goldfield.....	15,571
Gascoyne goldfield.....	7,421

One of the features of the progress made by the mining industry of Western Australia during the last two years, has been the rapid rise of a new district in the hills running a little to the north of the shore washed by the waters of the Great Australian



CUMBERLAND GOLD MINE, KOOKYRIE, NORTH COOLGARDIE GOLDFIELDS.



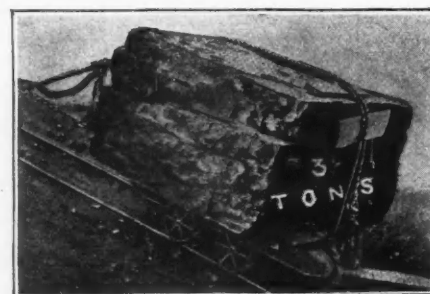
GENERAL VIEW OF THE BOULDER PERSEVERANCE GOLD MINING COMPANY'S MILLS AND WASHINGS, EAST COOLGARDIE GOLDFIELDS.

west, and in the Northampton District, copper and lead mining is being energetically prosecuted. In the southwest division, at Greenbushes, a considerable area of stanniferous country is being prospected, so that there is good promise of a large output of tin. The average grade of these ores so far as they have been tested, is high. The principal areas concerned are within easy reach of railway and harbor facilities. Smelting works have been established at Greenbushes, and the first experimental shipment of Greenbushes tin in ingot form has already been made. The output of black tin and copper ore has been as follows:

	Black tin.	Copper ore.
Previous to 1899.....	1,666 tons	7,018 tons
1899.....	355 "	2,964 "
1900.....	823 "	6,183 "

The production of coal in 1900 amounted to 118,410 tons, as compared with 54,336 tons in the pre-

vious year. As the mines increase in depth a better quality of coal is opened up, with the result that it



BLOCK OF WEST AUSTRALIAN COAL FROM THE WESTRALIAN WALLSEND COLLIERY, COLLIE COALFIELD.

is not only being utilized largely for domestic, mining and railroad purposes, but also by some of the

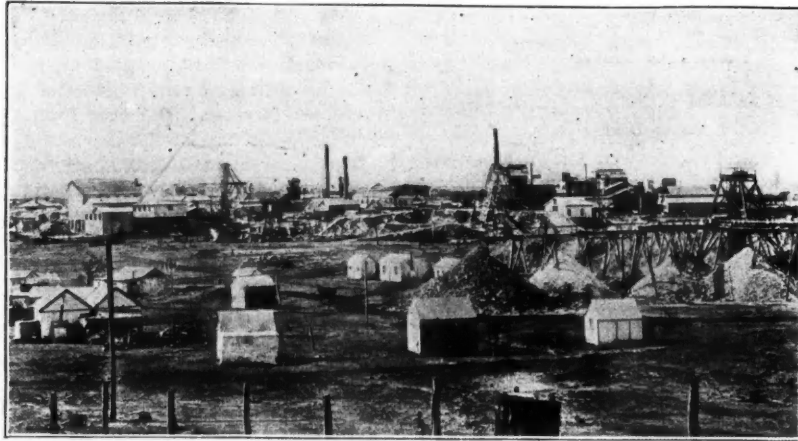


local steamship companies, which give favorable reports of its efficiency. The chief center of the coal-mining industry is the Collie River, but further discoveries are being made in other parts of the colony, which are likely to have an important bearing upon the future of this industry.

The three principal companies at work in 1900

The Kalgoorlie field is situated about 375 miles east of Perth, or nearly 400 miles inland. It is provided with a fairly efficient railway service, but even in spite of this the cost of living is high. What is known as the Golden Mile is a marvellously rich patch of country, right in the centre of the field, and here are to be found Kalgoorlie's big mines. In all

about north by 30° west and south by 30° east, and the oxide gives place to the sulphide anywhere between 40 feet and 150 feet in depth. In one or two mines cross lodes have been met with, but these are not of frequent occurrence. The lenses or lodes might fairly be described as auriferous, metalliferous, metamorphic, schistose, diorite and, owing to the presence of the diorite and diabase, managers were considerably put about at first to know when they were in country and when in lode matter. This was a minor difficulty, however, and managers and metallurgists were soon called upon to study the more perplexing problem of the economic treatment of the sulpho-telluride ore. However, I propose to touch on the different methods adopted and now in vogue for the treatment of the ore, later on. There are two runs of ore on the Kalgoorlie field which are worthy of special mention, and these are the Lake View Consols and the Hannan's Brownhill lodes. The former has been proved for a length of over 4,000 feet and courses through the Golden Link, Lake View Consols, Boulder, Perseverance, and South Kalgoorlie. The other lode has been worked by the Brownhill and Associated Northern, and its southerly continuation has recently been picked up by Hannan's Oroya, thus giving it a proved length of over 3,000 feet, and it is quite possible that it will be found in Associated ground. The



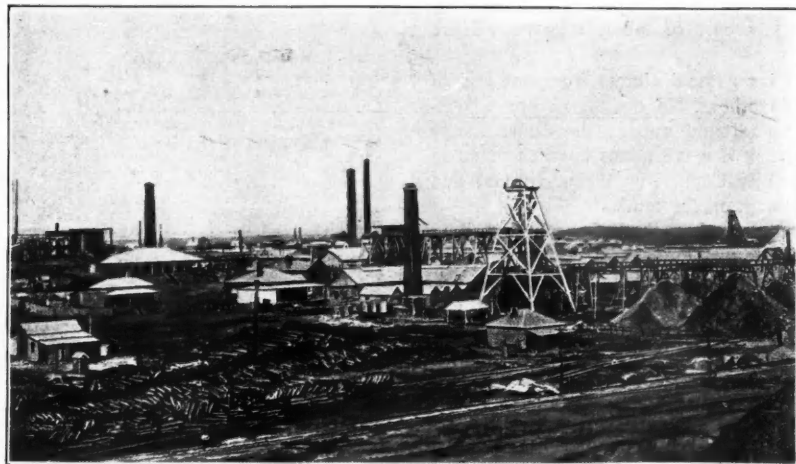
THE BROWNHILL GOLD MINE AND ASSOCIATED NORTHERN, EAST COOLGARDIE GOLDFIELDS.

were the Collie Proprietary coal-fields of Western Australia, Limited; the Western Australia Collieries & Fire Clay Company, Limited, and the Westralian Wallsend Colliery. The output of the latter company amounted to 88,342 tons.

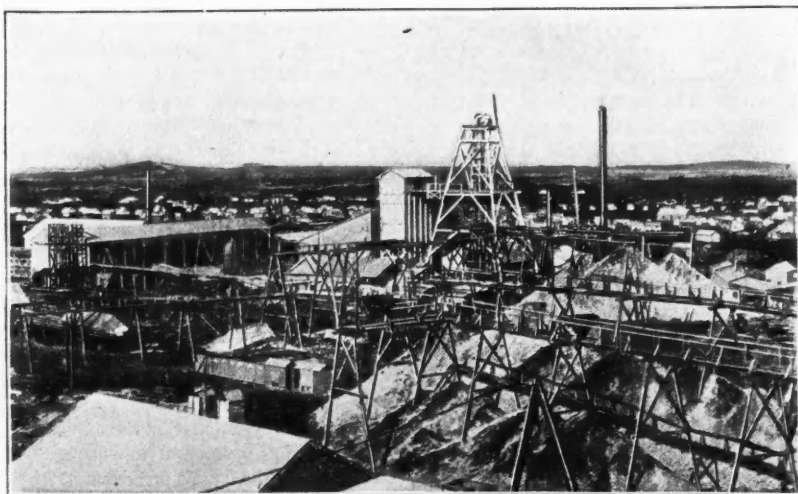
**THE KALGOORLIE GOLD-FIELD.**

By HARRY J. BROOKS.

When the history of Western Australia comes to be written the record of the discovery of the Coolgardie, and subsequently the Kalgoorlie gold-field will provide some remarkably interesting reading matter. It was in August, 1892, that gold was discovered at Coolgardie by Bayley and Ford, and 10 months later, or in June, 1893, Patrick Hannan made his memorable find at Kalgoorlie. Official records show that the gold yield of the State of Western Australia for the year 1886 was 302 ounces. In 1892, assisted by Coolgardie, the figures reached 59,548 ounces, and since the opening up of the big mines on the Kalgoorlie belt the yield has pro-



GREAT BOULDER, 1900, IN THE EAST COOLGARDIE DISTRICT.



THE GOLDEN HORSESHOE MINE, EAST COOLGARDIE GOLDFIELDS.

gressed at an amazing rate. The State's gold production for the year 1900 was 1,514,237 ounces, and from 1886 to the 30th of June, 1901, the grand total shows at 6,698,630 ounces valued approximately at £24,000,000. Of this yield the Kalgoorlie District is responsible for nearly 3,000,000 ounces, of an approximate value of £12,000,000 or one-half of the total output of the State. Roughly speaking there are about 17,000 men directly engaged in the gold-mining industry in the State, of which number about 6,000 are employed on the Kalgoorlie mines.

there are over a hundred mines in work, but the large and regular gold producers number about a dozen. The Great Boulder, although not the heaviest producer, takes front rank in the matter of development work, having proved the existence of its main ore body to a depth of 1,500 feet, or a couple of hundred feet below sea level. Next comes the Lake View Consols, with a depth of 1,000 feet, and the majority of the others are not far short of this depth. The ore occurs in lenses running as a rule

Associated Northern has treated approximately 6,000 tons of ore from it, and the average works out at over 8 ounces per ton. This is a rich chute, however, and the general average of the ore on the Kalgoorlie field may be said to run between an ounce and 30 dwts. per ton. The present monthly total is about 60,000 tons of ore for a yield of 90,000 ounces, but with the improvements and additions which are now being effected to several of the sulphide plants, the field should, early in the New Year, be in a position to turn out over 100,000 ounces of gold per month. To give some idea of the operations of the principal mines on this belt I append the following table, showing the October outputs (which may be taken as a fair average sample) and the total outputs to date:

	Tonnage for October.	Yield in ounces.	Total yield to date in ounces.
Golden Horseshoe .....	8,238	15,407	410,227
Great Boulder .....	7,840	12,899	574,467
Perseverance .....	10,326	13,307	244,556
Lake View Consols .....	9,386	14,396	659,513
Ivanhoe .....	10,990	11,214	391,474
Associated .....	3,155	2,927	243,570
Brown Hill .....	2,185	5,264	298,179
Boulder Main Reef .....	2,000	2,200	82,943
Kalgurli .....	1,470	1,845	32,920
South Kalgurli .....	1,900	1,912	24,491

It will be seen from the above table that the first five mines on the list have regular outputs of five figures, and the five are responsible for a total monthly gold yield of nearly 80,000 ounces. The Associated Northern has not yet taken rank as a regular monthly producer, and consequently I have not included it in the table, although the mine has to date treated 5,318 tons for 42,839 ounces, an average of over 8 ounces per ton.

## QUICKSILVER MINING IN CALIFORNIA

By GEO. A. TWEEDY.

Many people have the impression that the quicksilver deposits of California are exhausted, or, are nearly so. The only way to account for this is the slight decrease in production. While the greater mines are, in a measure, worked out, yet I feel certain that the quicksilver production of this State will continue to maintain a place of economic importance for years to come. While it is not likely that we will have another mine equal to the New Almaden, or New Idria, a small production may be expected from numerous mines throughout the State, varying from 20 to 300 flasks a month per mine. Ten years ago many people believed and, in fact, it was generally understood, that the New Idria, the Aetna, the Oat Hill, New Almaden and others, were practically worked out; nevertheless, these same mines have continued to produce and to declare substantial dividends.

Of course, there are reasons for this: In the first place it is difficult to know just when a deposit of cinnabar is exhausted; this is due to the irregularity of the deposits and the apparent difficulty in following the ore shoots. Owing to this, many extensive deposits have been overlooked by one operator, to be found by his successor. Again, in the early days, the desire to become rich quickly, caused many operators to rob the mines of their rich ore, and leave intact great deposits of a lower grade, which, in these days of improved methods of mining and reduction and low cost of labor, may be worked profitably.

Cinnabar has been found almost from one end of the State to the other. No deposit of any extent, however, has been found outside the Coast Range Mountains. The productive mines have occurred in and between Trinity County, on the north, and San Luis Obispo County, on the south.

Several years ago, when the price of quicksilver was high, the State was quite thoroughly prospected and numerous promising deposits were discovered. Just as these deposits were developed sufficiently to begin a production the price of mercury dropped to \$25 per flask. As most of these deposits were small and the material low-grade, the owners were obliged to suspend operations.

Now, that the price of mercury has again advanced and promises to go higher, these deposits are being reopened. There is greater activity in the development of the quicksilver deposits of California to-day than has been since the early seventies. With the reopening of the small deposits and the renewed energy in prospecting for ore bodies in the old mines, I cannot see why California should cease to be a producer of mercury, at least in the near future.

Much interest is being manifested, especially in Sonoma and San Luis Obispo counties. In the latter county, within the last year, two large plants have been erected and one of them is now producing. In Pine Flat, Sonoma County, many of the old and some new prospects are fast being developed.

Under ordinary circumstances, quicksilver may be produced in California at a cost of \$3 per ton, of ore mined and furnace. This makes it possible to work ores at a profit averaging one-half of 1 per cent mercury, and it is not infrequent that ores of a lower grade than this can be profitably treated. The merits of a quicksilver proposition are therefore apparent and especially so when we consider that a mine can be equipped in a small way for a few thousand dollars and made almost a paying investment from the start.

Of course, the business is not without its difficulties; in fact, I consider that it requires closer study and attention than any other class of mining. (I have in mind the operations underground). To maintain a steady output the ore reserves must be kept well in advance of the demands of the furnace. To do this taxes a prospector's utmost skill and ingenuity. The stringer may pinch out entirely or he may miss a large deposit altogether. He must study the special mine in hand because, if he resorts

to general laws and precedents, he may soon find them very misleading.

The ideas set forth in this article are deductions from recent investigations made for the coming bulletin on "Quicksilver," to be published under the direction of State Mineralogist Lewis E. Aubury, by the California State Mining Bureau. In this bulletin the several quicksilver mines and prospects in this State, together with their methods of mining, reduction, etc., will be described and discussed at length.

## ASPHALT IN DELTA COUNTY, MICHIGAN.

By ALFRED LANE.

The Trenton limestone, so well known as an oil producer in Ohio, passes under the Lower Michigan Coal Basin and outcrops in a belt which runs from the west shore of Green Bay, past Escanaba and Gladstone through Delta County to Neebish Island in St. Mary's River. The upper limit of the Trenton appears to be fairly well defined against the Utica black shales, as the following well record indicates:

<i>Lorraine beds—</i>		
Gravel and clay till.....	9	9
Blue shale.....	45	54
Fossiliferous limestone.....	13	67
Brown shale.....	28	95
Blue shale.....	20	115
Brown shale.....	8	123
Gray shale.....	70	193
Light gray shale.....	8	201
<i>Utica shale—</i>		
Bituminous shale.....	50	251
<i>Trenton—</i>		
Limestone.....	83	334
Fossiliferous limestone.....	55	389
White limestone.....	8	397
Dark limestone.....	9	406
<i>Calcareous—</i>		
Quartzite (?).....	6	412
Limestone.....	44	456
Quartz.....	1	457
Limestone.....	24	481
Blue shale.....	4	485
Black limestone.....	14	499
Limestone.....	19	518
Blue shale.....	4	522
Sandstone, soapstone and limestone.....	38	560
Red clay shale.....	1	561
Sandy shale.....	1	562
Limestone, soapstone and sandstone.....	66	628
Crystalline limestone.....	12	640

I do not guarantee the names of the strata, especially in the calciferous, which is really in large part a sandy dolomite, and the line between it and the Trenton is uncertain.

At the other end of the belt a well on Neebish Island beginning near the top of the Trenton went through about 148 feet of it, then about 75 feet only of calciferous mixed beds, and then entered at once 151 feet of clear white sandstone of good, rough quality for the manufacture of glass. It is apparently the Upper Potsdam, the balance of the way to a depth of 527 feet being a red sandstone, growing darker and conglomeratic with increasing depth. Both when it is struck in borings and in the outcrop, the Trenton shows signs of oil. In particular in cavities where exposed along the Rapid River there is more or less semi-fluid, dark brown, almost black, oil residuum or "gum." This was examined by Mr. Ruschhaupt, of Milwaukee, and gave the following results: Odorless until heated, then gives off an asphalt smell. At 185° F. foams, fully liquid at 200° F., foaming ceases at 300° to 330° F. Near 430° F. slight decomposition with evolution of a small amount of empyreumatic matter. At 554° F. boils, and after about 1-2 hour thickens, and boiling point rises. Boiled at 600° F. for 3-4 hour the residue cooled to 70° F. gave a hard tenacious asphalt. Perfect combustion left 5.08 per cent ash.

Perfectly soluble almost in gasoline, petroleum ether, benzene, ether, turpentine and chloroform, separating some water, and leaving only a small residue, to wit, the mineral and organic matter.

Of the crude bitumen, 42.05 per cent was soluble in petroleum ether, and 69.02 per cent in chloroform, none of it soluble in alcohol.

Summing up the result of distillation we have:

Distilled at 212° to 347° (mainly water).....	25.00
Distilled at 570° to 600° (mainly oil).....	45.36
Asphalt.....	24.56
Ash.....	5.08
Total.....	100.00

The oils were soluble in all the solvents mentioned except alcohol. Mr. Ruschhaupt says that there is

no petroleum in the distillate, and no paraffine, gum asphalt being the only base.

A company, of which M. D. Kelly is secretary, has been formed at Milwaukee, to see if the asphalt can be found in commercial quantities.

The dip of the formation appears to be fairly uniform, about 40 feet per mile to the south.

## COPPER IN NEW SOUTH WALES.

By JOHN PLUMMER.

For many years copper was regarded in South Australia much the same as gold is in Victoria and Western Australia, or silver and coal in New South Wales, but recently it has been ascertained that in the western districts of the last-named State are to be found some of the largest known deposits of copper, which, when properly worked, will aid in materially increasing the mineral output of the State. Mr. Edward F. Pittman, State government geologist, says there is every reason to believe that copper was the first metal to be worked in New South Wales, the earliest attempts at copper mining being probably made about 1844. Various rich deposits were subsequently discovered and sought to be worked, but in the western country the industry suffered under great disadvantages, not only in regard to the scarcity of fuel and water, but more especially on account of the great distances over which the ore or metal had to be carried by bullock-teams to the nearest railway station. In the case of the Great Cobar Mine the copper was conveyed a distance of more than 300 miles over bush tracks through country where there was frequently no grass. The cost of carriage, in such cases, amounted to as much as £42 per ton, so that only a mine of extraordinary richness could have continued working under such a severe handicap. It is hardly surprising, therefore, that most of the earliest copper mines were worked in a very unscientific manner, the method generally followed being the extraction of the richest oxidized ores, without consideration of the subsequent development of the mine at greater depths. In consequence of this near-sighted policy, it followed that the mines generally closed down when the rich ore of the upper levels gave place to poorer sulphides below, and more particularly when the impoverishment was accompanied by a fall in the market value of the metal.

At the present day, however, remarks Mr. Pittman, the world's increasing demand for copper, for industrial purposes, bids fair to maintain a good price for the metal, and, in view of the increased facilities for carriage, which have been, and are still, being effected, by the extension of the railways, and in consequence also of the improvements which have been introduced for the treatment of low-grade sulphide ores, there is every reason to believe that a new era of prosperity is opening for the copper mining industry in New South Wales. The story of the discovery of the rich copper deposits at Cobar is interesting. It should be mentioned that "Cobar" (or "Copar"), in the aboriginal language, signifies "Raddle" (earthy iron oxide), and, from the outcrop of the Cobar lode, the aboriginals formerly obtained colored earth for decorative purposes; in process of time a small circular excavation resulted from scooping out the soft ochreous material, forming a catchment for water, and serving as a "native well." In 1869 two Danes, Thomas Hartman and Charles Campbell, engaged at the time in boring for water in the district, camped at this native well, and were attracted by the rusty sediment at the bottom and the blue and green stains on the sides, and for a limited extent round it. Neither were at the time acquainted with copper ores. The narrative of the facts leading to the discovery of the real nature of the coloring which arrested their attention is in dispute. Briefly, the account of the surviving discoverer—Hartman—is that on raking the ashes of the campfire made alongside the well, he discovered beads of metallic copper, which he took direct to Bourke, and there displayed. The conflicting story is that Hartman and Campbell, taking with them specimens of the colored rock, proceeded on their journey until they fell in with a Cornish woman—Mrs. Kruge—the wife



of a selector, who at once recognized the true nature of the coloring. On ascertaining its value, Hartman and Campbell returned to Cobar, and subsequently secured the land as a mineral conditional purchase of 40 acres, in conjunction with a trusted partner. The latter, in May and June, 1876, also secured 40-acre blocks adjoining the Cobar on the north and south. In January, 1876, the South Cobar Mining Company was amalgamated with the Cobar, under the present title of Great Cobar.

Many difficulties and even losses were experienced in working the mines, but the dividends paid up to the close of 1898 amounted to £202,000. Gold is found with the copper. The Nymagee Copper Mine, in the neighboring district, was purchased in 1896 by the Cobar Mining Syndicate, which introduced a blast furnace for reducing, and subsequently started pyritic smelting. The Nymagee copper has always been of good quality; it contains a small proportion of silver, but no gold. The Girilambone Copper Mine is situated on the western railway line, at a distance of 405 miles from Sydney, and was first opened in the year 1880, by Hartman and Campbell, the discoverers of the Great Cobar Mine. The mine was closed down from 1885 and 1893, and also during the years 1895 and 1896. Towards the end of the latter year it was floated into a company named the Girilambone Copper Mining Company, Limited, and mining operations have been carried on ever since. The copper deposits at Mount Hope were discovered in 1878, and although imperfectly worked by tributaries, 5,543 tons of copper, valued at £296,656, have been obtained. The whole country for many miles around is rich in copper lodes, and in several places, Mount Allen for instance, there is a considerable proportion of gold.

A large amount of capital has lately become invested in the State copper mining industry, and with the introduction of improved methods of dealing with the ore, a considerable addition to output is anticipated. In 1900 the New South Wales exports of copper amounted to 6,665 long tons, value £468,397, representing, with 853 tons of copper ore, value £7,094, and 617 tons of copper in matte, value £25,839, a total of over £500,000. Many miles of country, believed to be copper bearing, remain to be prospected.

#### ELECTRO-METALLURGY IN GERMANY IN 1901

In a review of the electro-chemical and electro-metallurgical processes in Germany contributed to the London *Electrical Review*, Mr. J. B. C. Kershaw calls attention to the fact that owing to the scarcity of raw copper suitable for refining by the electrolytic process, but little if any expansion is probable in this important branch of the metal industry. At the present time there are nine electrolytic copper refineries in Germany, which, however, are of small size and limited output.

Concerning the Elmore electrolytic process for the manufacture of tubes and sheets, one interesting comment is made on the work done at the Schaldern refinery, where 1,000 h. p. is said to be used, and the cost of refining is less than in England.

The Hoepfner electrolytic process for the extraction of copper direct from its ores is operated at Pappenberg in connection with a nickel process, cuprous chloride being used as the leaching agent. This plant has been but recently installed, and it is yet too early to say whether it has proven to be a practical success.

The Siemens-Halske electrolytic process for dissolving copper from sulphur ores by the action of ferric sulphate containing free sulphuric acid, was tried some years ago, but was unsuccessful from a commercial standpoint and the Marchese electrolytic process for refining copper matte direct also proved a costly failure at Stolberg where a plant was operated.

For the manufacture of aluminum, the Neuhausen Company with its works at Neuhausen and at Rheinfelden, has 9,000 h. p. available for the purpose, although the whole of the power is not used. While reliable data are not available, this company is con-

sidered to be one of the most successful electro-metallurgical companies in Europe, and has paid annual dividends of from 10 to 13 per cent on its capital stock of \$3,077,000.

Gold and silver are electrolytically refined by three plants located at Hamburg, Frankfort and Pforzheim, the process being similar in principle to that used for refining crude copper. The anodes are of gold or silver bullion, immersed in a suitable electrolyte and plates of pure metal form the electrodes; by passing the current, the electrolyte dissolves the silver or gold from the anode plates and the pure metal is simultaneously deposited therefrom at the cathodes, leaving the impurities in the electrolyte, or adhering to the anode plates in the form of a mud which is called "sludge." Gold bullion frequently contains platinum or palladium, which is regarded as an impurity and as these metals can be separated with comparative ease from the sludge, the electrolytic process for refining offers a special advantage in this respect. The value of the output from the refineries at Hamburg and Frankfort during 1900 amounted to \$12,500,000.

Nickel is used by an electrolytic process at Siegen and at Pappenberg, where ores from New Caledonia are treated by the Hoepfner process. It is too early, however, to consider that the success of the process has been demonstrated. The reported daily output of nickel at the Pappenberg works for 1900 averaged about 1.5 tons.

#### THE ENGINEERS' CLUB OF PHILADELPHIA.

The Engineers' Club of Philadelphia, celebrated its 24th anniversary on December 21. This organization has been one of the most successful of the local engineering societies, holding two regular meetings for the presentation of papers, occasional conversations, and also having each year one or two excursions to inspect prominent engineering features.

No effort to make the 24th anniversary a public affair was made, but the members assembled in their club room, and after congratulatory remarks from Henry Leffman, president, Mr. John Birkinbine, ex-president of the club, presented a paper upon "Some of the Great Things which make This Country Great." This paper considered the marked instances of progress, particularly as they were affected by the work of the engineer, instancing notable bridges, harbor improvements, subways, unusual features of railroad construction, the development of water power and the application of electricity in large units, the construction of dams for water supply and irrigation, and canals for transportation, drainage or irrigation. He also spoke of the great development of the mining industry, its extent, transportation problems on land and water, the growth of our inland marine, especially as affecting the transportation on the Lakes, the construction of vessels on the sea coast, the largest output of locomotives and cars, and by numerous lantern slides emphasized the statistical figures which were interspersed by illustrations of prominent instances in each of the specialties discussed.

Following this paper, the president called attention to the proposed Appalachian forest reserve and gave illustrations of the topographical features of the territory to be embraced, and the meeting adjourned for a social luncheon.

#### OBSIDIAN.

Prof. W. H. Holmes, of the United States National Museum, recently visited and described the obsidian mines, in the State of Hidalgo, Mexico,<sup>1</sup> the principal source of the obsidian that is found so widely distributed over the whole Southwest. The spot has been examined and described in 1856, by Prof. E. B. Tylor, of Oxford, England, but scarcely since then. The mines are located on the Guajalote estate, near Pachuca, some twenty or more miles from the railroad, on the lower slope of the Sierra de las Navajas (Mountain of the Knives). They must have been worked for a long period.

<sup>1</sup>Amer. Anthropologist, Vol. 11, No. 3, pp. 405-416.

They cover hundreds of acres, for a length of one to two miles. There was little proper mining, mainly pits and trenches of a few feet in depth, separated by heaps of debris, composed of flakes and fragments of the sharp, slippery, glassy obsidian, all overgrown with underbush and long grass, and exceedingly difficult to traverse.

The obsidian itself was not seen; it must lie very near the surface, in irregular beds or extensive masses. But the pits were fitted with debris, and the actual occurrence was not visible.

Stone hammers, of tough lava, worn and battered by use, were the only tools found. Traces of rude stone buildings were recognizable, and also the points where the obsidian taken out was tested and trimmed into "cores," to be sent all over Mexico for flaking into knives, etc. These places were marked by immense piles of flakes and rejects, unmixed with earth, and all sharp and fresh, although the working had been abandoned for four centuries.

Prof. Holmes gives many interesting details as to the testing and shaping of these obsidian cores, and the method of flaking knife-blades, etc., from them. The cores were the form in which the material was taken away, as the product of the mine; and the flaking was done wherever the implements were needed for use, until the core was reduced to one of the exhausted nuclei so common all over Mexico.

#### NEW METHOD OF HARDENING STEEL IN GERMANY.—United States Vice-Consul

General Murphy sends from Frankfurt, November 23, 1901, translation from the *Frankfurter Journal*, as follows: "The Technical High School in Charlottenburg has just completed a series of experiments with a new method for preparing steel, and the result will no doubt attract much attention in interested circles. The inventor, named Giebler, is a small manufacturer in Mecklenburg, who has for years been interested in this new process, but was unwilling to bring it before the public until it had been thoroughly tested by experts. The results reached at the Technical High School were most satisfactory. By the Giebler process, all sorts of iron can be given strength and hardness double that obtained by the Harvey, Krupp and Boehler processes, in spite of the fact that the cost of production is reduced 50 per cent. Projectiles fired against a 7/8 millimeter sheet of steel produced by the Giebler process penetrated only to the depth of 1 millimeter.

#### GASOLINE ENGINES IN THE FAR NORTH.

—The Weber Gas and Gasoline Engine Company, of Kansas City, Mo., has received the following letter from the Norwegian Copper Company, Limited, of Tromso, Norway. The feature of interest in regard to this letter is that the engine has been installed at a point in the extreme north. Tromso is farther north than Iceland, and this letter is intended to prove the falsity of the generally accepted theory that a gasoline engine is not a satisfactory power in extremely cold countries. The engine referred to is a 25-h. p. engine which has been in use in the company's concentrating plant for the last two years:

"Gentlemen: In receipt of your letter of September 9 I am glad to tell you that we are very satisfied with the 25-h. p. gasoline motor we have received from you. As gasoline is very expensive in Norway, I have built the motor to run with Russian petroleum, with which it now is running very satisfactorily."

The Weber Company has also recently received a letter from the Sta. Maria, Sonora, Mexico, the opposite kind of a climate, in which the writer states that the engine received is at work and performs its labor with ease. A Yaqui Indian runs it. He learned how to manage it in two hours, and gives, like the engine, entire satisfaction. The Yaqui Indians and the gasoline engines are both considered "a superior article."

**NEW EQUIPMENT AT THE KILBOURNE & JACOBS MANUFACTURING COMPANY'S PLANT.**

A great many improvements are under way at the Kilbourne & Jacobs Manufacturing Company's plant, in Columbus, Ohio, which when completed will, in addition to increasing the capacity of the works, and facilitating the output, constitute one of the most modern installations of mechanical and electrical machinery in the country.

A new power and engine house of steel and slate construction is being erected at a central point in the works, and in this building will be located the new battery of water tube boilers, engines and dynamos which will generate the power that will be required in the several departments. The steam engines throughout the plant will be replaced by electric motors and in many cases individual motors will be used on the large power machines. The power sets, which are of the most approved type, consist of two 300-h. p. tandem compound engines direct connected to 200-k. w., 3-phase, 60-cycle alternating current generators, and will generate a current of 240 volts pressure. The dynamos were especially designed and are of the latest compensated revolving field type.

The engines, which were also especially designed, with dash-pot governors and extra heavy fly wheels, in order to meet the running requirements of the generators, will operate in parallel and govern within one-tenth of one degree per revolution.

A compound duplex air compressor, capable of supplying between 500 and 600 cubic feet of free air a minute is being installed and the large size of this machine indicates the extent to which this modern power will be utilized for riveting, drilling, chipping, caulking, wood boring, hoists and spray painting, etc.

This will be the first installation of this kind of alternating current electrical apparatus for power purposes in Ohio, and one of the first in the country. The current will be used for arc and incandescent lighting and electric welding in addition to the regular power requirements.

In addition to the improvements in the power equipment, several new buildings are under construction and a large number of new and modern special wood working and machine tools are being installed, and it is expected that when the improvements are completed this company will be better able than ever before to take care of its increasing export and other business.

**COLORADO MACHINERY IN MEXICO.**

The J. H. Montgomery Machinery Company, Denver, Colo., has recently shipped to Col. Morrow at Guanajuato, Mexico, a car-load of mining machinery. In this shipment was included ore feeders, a Montgomery patent self-contained 5-stamp mill, 2 engines, a large tubular boiler, boiler feed pump, concentrator, etc., etc. The company also reports a recent shipment of a large consignment of ore buckets and mine cars to Mexico City, and a similar shipment to Chihuahua, Mexico. This firm reports a prosperous year, having been obliged by increase of business to add a large 2-story addition to its original plant, which more than doubles its capacity for turning out work. The specialties made are whims, ore cars, ore buckets, high-grade rolls and crushers, aerial tramways and all mine, mill and smelter supplies.

**FROM PITTSBURG TO SOUTH AFRICA.—**

The De Beers Consolidated Diamond Mines of Kimberley, South Africa, has just placed an order through Westinghouse, Church, Kerr & Co., of New York, for two 1,000-kw. alternators, directly connected to Westinghouse-Parsons steam turbines. The alternators will be furnished by the Westinghouse Electric and Manufacturing Company, of Pittsburg, Pa., and having in mind the usual promptness with which this firm fills its orders there will be no delay in getting off this shipment.

**CEMENT EXPORTS FROM GREAT BRITAIN.**—Exports of cement from Great Britain for the 11 months ending November 30 are reported at 285,349 tons, against 337,783 tons for the corresponding period in 1900. The exports to the United States were 7,755 tons this year, against 33,860 tons last year, showing a decrease of 26,105 tons.

**EXPORTS FROM NEW YORK**

In the following table is presented a statement of the exports of mineral products and the manufactures thereof during November, 1901, and for the eleven months ending November 30. The total value of the exports from New York in November last year was \$6,245,607, a decrease of \$7,535,252 for the same month in 1900. This decrease was principally shown by the manufactures of iron and steel (bars, rails and sheets), the falling off in these lines amounting to \$730,000 (including manufactures). Copper exports decreased \$390,666, and mineral oils lost \$252,531, chiefly in lubricating grades.

Articles:	November.		Jan.-Nov.	
	Quantity.	Value.	Quantity.	Value.
Coal, anthracite, tons.....	4,666	\$20,301	90,478	\$377,145
Coal, bituminous, tons.....	4,702	14,655	54,799	174,841
Copper, ore, tons.....	1,958	320,320	11,943	1,847,458
Copper ingots, etc., lbs.....	7,573,550	1,287,986	120,897,193	26,259,760
Copper manufactures.....	.....	88,967	.....	816,528
Copper sulphate, lbs.....	3,407	211	37,356,228	1,758,791
Iron, pig, tons.....	1,017	17,067	10,488	190,775
Iron, scrap, tons.....	105	2,002	1,538	28,574
Iron hoops, bands, lbs.....	44,904	1,091	1,924,458	41,734
Iron and steel bars, rods, lbs.....	1,233,246	29,601	52,074,136	995,808
Iron and steel sheets, ingots, lbs.....	.....	.....	5,060	143,227
Iron, structural, lbs.....	503,198	15,330	28,255,383	522,959
Iron and steel wire, lbs.....	2,465	140,245	32,288	1,842,259
Iron and steel manufactures.....	14,699,543	342,081	124,877,114	2,960,729
Iron and steel nails, lbs.....	.....	344,862	.....	3,967,084
Lead, pigs, etc., lbs.....	1,782,352	44,114	39,341,052	867,652
Lead, manufactures.....	4,446	209	49,487	2,546
Mineral oils, gals.....	.....	8,603	.....	114,140
Nickel, lbs.....	43,714,924	3,280,920	546,877,735	40,805,339
Zinc ore, tons.....	495,487	117,184	5,336,143	1,428,350
Zinc, pigs, lbs.....	2,031	50,655	21,059	619,095
Zinc manufactures.....	37,294	1,740	3,589,739	146,605
Steel rails, tons.....	.....	795	.....	12,516
Roofing slate.....	2,994	72,084	106,038	2,963,121
.....	.....	43,684	.....	368,241
Total values.....	.....	\$6,245,607	.....	\$89,256,177

**LOCOMOTIVES BUILT IN 1901.**—The Baldwin Locomotive Works built in 1901 a total of 1,391 engines, of which 530, or about 40 per cent were of the compound type, 45 were electric locomotives, and 6 were driven by compressed air. The firm exported during the year 174 engines, or 12½ per cent of its total production.

**NEW YORK MINING STOCKS IN 1901.**

Trading was largely professional during the year 1901, and prices fluctuated widely owing to the circulation of contradicting reports, especially about copper. The bears were most active, and succeeded in making low record prices for many stocks that were considered a good try at the high prices of

1901. In the closing month, however, the bulls are again in control of the market, and prices are rapidly recovering.

The copper stocks were the feature, notably Amalgamated, the great decline of which was the sensation of the last quarter of the year. Among the important matters that influenced the market and assisted the operators to unsettle prices were trial of law suits pending against the company in Montana courts; the reduction in the annual dividend rate, owing partly to smaller earnings by subsidiary companies; and the cut in the price of copper, resulting from a large decrease in export trade. Consequently the market value of Amalgamated shares opened at \$90.50 in January, rose to \$130 in June, and dropped to \$60.50 on December 17, the lowest price on record. In 1900 the stock yielded 8 per cent, while in the last quarter of 1901, it was reduced to a 4 per cent basis. Anaconda, controlled by Amalgamated, also showed important fluctuations, but trading was not as extensive. In April \$54.50 was the highest price this year, while in December it broke to \$28.50, the lowest yet touched. The dividend rate on Anaconda has been reduced from a 16 per cent to a 10 per cent annual basis.

Tennessee Copper shares have been active, as the company erected an extensive plant on its property, and is working satisfactorily. The stock was traded in on curb, where prices were influenced by the stocks called on 'change. In April Tennessee touched high water mark at \$28 3-8, while in December it was down to \$9 1-4. British Columbia Copper was in good request, selling at \$22 3-4 in January, the highest for the year, and at \$9 in December. Union, of North Carolina, was made active by speculators on curb, who sent prices to \$8 1-4 in April and \$3 1-2 in February, the highest and lowest this year.

The more important gold and silver stocks, those that pay regular dividends and are ably managed, seldom record a large sale and invariably at advancing prices. A notable example is the Homestake in the Black Hills, S. Dak. In 1900 sales of the stock were made at \$35@38, while in 1901 the price advanced to \$104, the last sale being reported in September at this figure. This company pays 50 cents per share monthly, or \$1,260,000 per year, which is equal to 6 per cent on the capital. Ontario Silver, of Utah, rose to \$13 in September, from \$6 1-4 in January, owing to the payment of good dividends. Horn Silver, also of Utah, was strong, selling at higher prices than in 1900, and advancing to \$2 1-4 in October. The dividends this year, amounting to \$72,000, are the largest since 1898.

Standard Consolidated Gold, of California, has been favored by the continuance of the 10-cent quarterly dividends. The extreme prices were \$4.35 in February and \$2.65 in August. Brunswick suffered from assessments amounting to 8 cents per share, breaking the market from 29 cents in March to 6 cents in October.

Cripple Creek, Colo., stocks were bought chiefly for investment, as the gold production of the district has largely increased and dividends have grown proportionately. Portland, which pays 24 per cent annually on its capital of \$3,000,000, is closely held, and the small sales made were at \$3.35 in January, and \$2.30 in March. Elkton, a 13 per cent dividend stock, has fluctuated in price owing to the heavy flow of water in the mine, early in the year, and to the uncovering of a rich chimney of ore in October, which resulted in the payment of an increased quarterly dividend. Isabella was capricious, owing to manipulation in the Western market. Only one quarterly dividend was paid in 1901, as work in the lower levels of the property proved unprofitable, and the future depends upon the development of new territory. In February 82 cents was paid for the stock, but in December it broke to 30 cents, with few bids in the market.

The Leadville stocks were handled principally by room traders. Iron Silver was strong, advanc-



ing from \$1.10 in April to \$2.25 in October. Breece paid three quarterly dividends of 5 cents each, and in December distributed 20 cents, making the year's payment \$40,000 larger than in 1900. Consequently little stock was offered for sale, at the extreme prices of \$1.70 in June and \$1 in November. Alice, of Montana, though it receded from 84 cents in January to 37 cents in April, showed comparatively small transactions as the property is not yielding according to expectations.

In the Comstock list only professional dealers are interested, as the continued large assessments have frightened the general public. Prices were noticeably weak, Consolidated California & Virginia selling down from \$2.80 in January to \$1.30 in May. Ophir's extreme prices were \$1.20 in June and 35 cents in April.

The California quicksilver shares were in active demand as the price for the metal continued high. Prices of Quicksilver preferred advanced from \$7 in March to \$12.75 in May, on payment of a dividend. The common stock was also up, from \$1.25 in April to \$5.25 in May.

#### THE BOSTON MINING STOCK MARKET IN 1901.

By OUR SPECIAL CORRESPONDENT.

A resumé of the mining market for the year is one of regret and but little satisfaction can be derived from the fact that while Boston was looked upon as the center of copper mining and speculation a few years ago, so far as the brains and money are concerned, she has had to take a back seat of late. This dates back to the time when the Amalgamated Copper Company was floated, which was in May, 1899. Boston's leadership in this direction was doomed from that time. It has been coming gradually, but it certainly is felt now as it never has been before. During the year many changes have taken place. Boston & Montana and Butte & Boston have been absorbed by Amalgamated. These two, and particularly the former, have furnished many incidents in their career. They have both brought riches to their owners, although the Butte & Boston did not until representatives of the Standard Oil had taken a hand in it. Butte would probably never have proven a bonanza if it had been left to work out its own salvation. With the Boston & Montana it is another story, although in its early days it came near wrecking its owners. This occurred when the smelter was being built and a snug debt had been piled up after it was put into operation. At that time an issue of stock put out at \$25 had to be taken by the underwriters, when the market was close to \$16 per share. The Comanche Claim was what saved the day then and holders have seen the stock go to the equivalent of \$500 per share, when it went into the Amalgamated. Control of Butte was secured close to \$2 and on top of this a \$10 assessment was paid. Subsequently \$8 was distributed to holders, and it went into Amalgamated at \$125 per share. Boston & Montana stockholders received \$43 per share in dividends for 1900 and were promised the equivalent of \$40 per share when it went over to the Amalgamated Company, but at present they are getting at the rate of \$16. In the meantime they have seen the stock sell at the equivalent of \$240 per share, as in the exchange four Amalgamated shares were given for one of Montana, Butte went in share for share.

Almost the first thing that meets the eye in looking over prices for the year is the depreciation in values. The average of the leading Boston copper stocks is about \$50 under the year's highest, and if the shrinkage is put in the aggregate it reaches the enormous total of close to \$250,000,000, which is indeed a sorry record for one year. Of course, the Amalgamated concern furnishes almost one-half of this loss, while Calumet & Hecla has contributed a depreciation of \$32,500,000 in the year. Calumet's fluctuations are wide when they take place. For instance, one day in December the stock dropped \$55 per share, which represents a shrinkage for the day of \$5,500,000 in the company's value, the capital being 100,000 shares. Calumet & Hecla reached \$860 in March and has been down to \$535 in the meantime. Arcadian has made a sorry record, and it is doubted

if the drop in this stock has ever been equaled in so short a space of time. It has always been affiliated with Standard Oil names. Early in 1899 it touched \$95¼, which was its top price. This was in the boom period, when no expense was spared to open up the mine with expectations of making it second only to Calumet & Hecla. The following year it sank to \$13½ and a few days ago it touched \$3½. Now the mine is reported to be closed down entirely and one of the best equipped mills for copper mining awaits a customer. At present the Trimountain is using one head of stamps. Happily the loss has not been general, as the stock was held by a few.

The cut in copper makes it problematical as to the outcome of some of the so-called second-class mines. Under 17-cent copper there was a profit in mining for most of them, but a 12 or 13-cent market is another question. Some of them will have to go out of business, and those that are still in the development stage will find it exceedingly hard to raise fresh money with which to pursue their work. Franklin is one that can make no money. Mass is said to be another one, although the latter has just equipped a first-class mill and is stamping rock. An assessment was lately paid to the Mass treasury. The success of the Adventure is questioned under the ruling price of the metal, although nothing definite can be stated. The company is now erecting a stamp mill and the \$3 assessment lately paid has been wiped out twice over since copper was cut. These stocks sell close together, the Mass being favored. Isle Royale is another mine that cannot work at a profit under existing conditions, although it has a modern mill. The rock is lean, but of late selected ore has been put to the mill. The price has been cut in there during the year. Centennial has received a knockout and the stock has sunk close to \$10. The Stanton Group of mines stand well and count for honesty and conservatism. Included in this group are Wolverine, Atlantic, Baltic, Copper Range and Mohawk. Wolverine and Atlantic can both be worked successfully under present conditions, while Baltic and Copper Range, now that consolidation of these two has been effected, will probably prove to be one of the large producers at Lake Superior. Copper Range also has a one-half interest in the Champion Mine, which has proven to be a valuable proposition.

Such mines as Allouez, Michigan, Old Colony, Rhode Island and Trinity are as yet only prospects, although large things are talked for the latter. The Bingham Consolidated and Utah Consolidated properties are both in Utah and are successfully treating the siliceous ore of that region. Both have up-to-date smelting plants. The Utah is paying dividends, while some disappointment is felt that the Bingham is not. United States Mining is another Utah proposition. Consolidation with Centennial-Eureka, an adjoining mine, was effected early in the year and with the completion of a smelter it is said by the management that \$4 or \$5 per share can be earned on 12-cent copper. The issue of new stock in lieu of bonds is favorably commented on.

Boston's experience with gold and zinc properties has been a sad one. Merced Gold of California, which at one time touched within a fraction of \$50, is hardly quoted. The last was \$4 asked. Little or nothing is heard of it. Pioneer has been reorganized and bears the name of Pioneer-Lynn. It is now a curb stock quoted at about \$1. Even at this price it represents 75 cents paid in for assessments. Work is going on at the mine again since the last 50-cent payment was made. Consolidated Mercur has drifted down to \$1¼, even though 50 cents is being paid per year. Guanajuato, a late aspirant for honors as a gold mine in this market, is down to \$4. Quite a furore was made in the market over this stock during the fall, when it reached \$9 per share. American Zinc, Lead and Smelting is a reminder of the boom days of 1899. It is quoted around \$9. Continental Zinc and Lead Mining and Smelting is practically out of this market, although it never ranked well.

The Quicksilver mines have been very quiet with but few sales during the year.

Withal, there is one thing to bear in mind. During the period of high copper, which covers a period of

some three years, conservative mining companies have put themselves in the best possible condition during the era and are in a good condition to withstand a lower price for the metal. They have been able to open and develop new portions of their mines and lay aside a comfortable surplus. At the same time a lower price for copper means that eventually the cost of production will be minimized. During good times the workman has received better wages and the cost of all kinds of material for construction has been high. As the proprietor finds his income diminishing, so will the employee, and no doubt the wages of the miner will be cut for the same reason that they were advanced during the period of prosperity. This alone is quite a factor in the cost per pound of copper, so that it is fair to assume that that cost will be considerably lowered, although the profit will not be proportionately as great as when copper ruled higher. The present cost should not be taken as a criterion for what copper can be produced when mining companies are close-hauled and when every energy is bent to keep expenses down.

While mining stocks have been the principal feature in the Boston Stock Exchange during the year, no record is kept showing just what proportion of the total sales has been of mining shares. A fair estimate would be 10,000,000 shares of the total of 16,000,000. There are some 40 Lake Superior copper mining companies whose shares are listed here, while but six pay dividends, namely, Calumet & Hecla, Tamarack, Quincy, Osceola, Wolverine and Atlantic. The total paid by these companies for the year amounted to \$7,496,900, which compares with a total of \$9,798,000 for 1900 and \$12,318,000 for 1899. This year's total is reduced by reason of the fact that Calumet & Hecla shifted its quarterly period so that but three payments came with the year. Four Montana companies have also paid dividends, namely, Boston & Montana, Butte & Boston, both now absorbed by the Amalgamated Company; Anaconda and Parrot. The total paid by these companies for the year has amounted to \$11,014,175, against \$13,585,100 for 1900, the reduction being due to the fact that Boston & Montana's dividend amounted to \$35, against \$43 in 1900, and the Butte & Boston distributed but \$3 against \$5. The Anaconda's disbursement was \$900,000 smaller owing to the passing of the usual extra dividends. The Lake Superior mines have distributed in dividends during the past 23 years over \$90,000,000, of which the Calumet & Hecla has contributed 70 per cent. The total dividends paid to date by the Montana mines aggregate \$54,309,980, of which Boston & Montana furnished \$26,225,000 and Anaconda \$20,850,000.

During the year Calumet & Hecla touched \$860 for high and \$535 for low; Tamarack, \$363 for high and \$230 for low; Quincy, \$187 and \$125, respectively; Osceola, \$120 and \$72; Wolverine, \$74 and \$44; Atlantic, \$43 and \$24½; Anaconda, \$53 and \$29; Parrot, \$58½ and \$27. Arcadian's range during the year has been \$24¼ for high and \$3½ for low; Baltic, \$53 for high and \$30¾ for low; Centennial, \$34¼ and \$10½, respectively; Copper Range, \$83 and \$34; Franklin, \$25½ and \$11½; Isle Royale, \$56½ and \$18½; Mass, \$37¼ and \$11; Michigan, \$20¾ and \$5½; Mohawk, \$56¼ and \$22; Old Dominion, \$38¾ and \$20½; Trimountain, \$60 and \$19½; Trinity, \$41 and \$10; United States Mining, \$24 and \$9¼; and Utah, \$37½ and \$18½.

The closing announcements of the year are a dividend of \$10 on Calumet & Hecla, payable in January, the amount being \$5 less than was paid in October; and an assessment of \$3 on Trimountain, also payable in 1902.

#### THE LONDON STOCK MARKET DURING 1901.

By OUR SPECIAL CORRESPONDENT.

The year 1901 has been a very unsatisfactory one for the mining market in London as regards both speculation in the shares of mining companies and the flotation of new ventures. The South African market has been practically at a standstill all year, and the enthusiasm of speculators has been dampened by the Whitaker-Wright collapse. It is true there has been a little boom in the flotation of West African com-

panies, but it did not last for long and was not of general interest owing to the difficulty of obtaining workable properties.

The South African market has not been available for speculation, chiefly owing to the depression of spirits brought on by the dragging on of hostilities. Work on the Rand was not resumed until April and for some months the opening up was very slow. The difficulty of catching the enemy remaining in the field, and the occasional defeats of small British forces simply depressed things without giving either bulls or bears any opportunities. During the last few weeks of the year, the military operations have progressed more rapidly so that the market has waked up considerably, and it is hoped that with the new year a period of greater prosperity may arrive. The Rhodesian market has been depressed in sympathy with South Africans generally, and though mining and milling operations have not been hindered to any great extent by the war, the expansion of the country generally has been checked, a few new Rhodesian companies have been floated, but the money required has always been obtained privately and not from the general public.

The West African boom, which was in full swing during the earlier part of the year, has now quite ended, and has given no satisfaction to anybody. A very large number of companies were floated by the aid of underwriters, but the public did not come in very liberally. Mining men have visited the district with prospecting parties and the country has been very thoroughly looked over. The majority of the concessions have been reported on adversely, while such properties as are promising are hampered by bad communications, unsuitable labor, and considerations of climate. At the present time the market in the shares is quite dead and sales cannot be effected at any price.

The sensation of the year has without doubt been the collapse of the Whitaker-Wright companies. Almost immediately after Christmas a year ago the London & Globe Finance Corporation suddenly became insolvent, and shortly afterwards the British-America Corporation and the Standard Exploration Company followed suit. The shareholders in the first named consented to a voluntary liquidation, with a prospect of early reconstruction, but owing to the knowledge gained subsequently, the other two were forced into compulsory liquidation under the management of the official receiver in bankruptcy. After the report of the official receiver on these two companies had been published, the shareholders and creditors of the London & Globe petitioned for this company also to pass into the hands of the official receiver. This change was accordingly brought about and at the time of writing the first report of the official receiver has just been made public. The cause of the collapse is now found to have been wild speculation in the shares of subsidiary companies, the loss of money due to bear raids and the defection of supposed supporters. The large amounts of money raised from shareholders in these parent companies and in the subsidiary companies appear to have been devoted chiefly to Stock Exchange gambling, instead of to the legitimate development of mines. The chief subsidiary companies—Ivanhoe, Lake View Consols and Le Roi—have been removed from Whitaker-Wright influence, while the Nickel Corporation has been practically sold to the Carnegie people. The final clearing up of the wreckage will take some time and in connection with the winding up of the companies some more disclosures and developments may be expected. The effect of this collapse on the mining market has been very great and the public seems to have been cured of mining speculation for the present.

The West Australian market has been unpopular all year among speculators, owing to the continued uncertainty with regard to the directors' and insiders' statements as to ore reserves. It is so generally felt that outsiders have no chance that the public has lost interest to a large extent in this market. The Whitaker-Wright influence has been weeded out, and Mr. Bottomley has abandoned mining, so that the chief speculative interest is now in the hands of the

Kaufman group. The sulphide problem has been solved at most of the mines, and the production of gold has become more regular. During the earlier part of the year the properties belonging to Mr. A. S. Morgans were floated in London, but there are not many dealings in the shares. The Peak Hill gold field has attracted notice by the development of immense bodies of low-grade ore and by provision of new capital to provide plant to treat them on a large scale. Considerable headway has also been made on Great Fingall, in the Murchison District, and as the mine promises to become a large producer, the shares have been in demand.

The Broken Hill companies have been quiet all year, as far as the stock market is concerned, though their work has progressed without interruption. The same may be said of the Mount Lyell Group, where the only item of interest has been the absorption by the Mount Lyell Mining and Railway Company, of some outlying companies for the purpose of using their low-grade ores for fluxes.

The Indian Group has been very regular all year, and most of the companies have issued new capital to enable operations to be carried on on a larger scale. Among New Zealanders, Waihis have been most prominent and in this case also additional capital has been provided to extend operations.

The shares in copper companies have fluctuated with the price of the metal and during the past half year the market has been not at all strong. Hardly any new copper companies have been formed, chiefly because of the reaction in the price of copper, but also because of the difficulty in finding suitable properties.

The attempt to float the Siberian Gold Fields Company, made by Mr. Hooley and his friends, has been one of the conspicuous failures of the year. Large amounts of money were obtained from the public by the sale of vendors' shares, but the Russian Government refused to grant the concessions, so that the shares so purchased are practically valueless. Companies to prospect in Egypt, Abyssinia and the Sudan have been formed, some of them under very influential auspices, and they already promise well.

The American mining market has been set back considerably by the Whitaker-Wright collapse and by the Stratton's Independence episode. Though Stratton's Independence is now shaping better than was expected after the collapse, rather over a year ago, the public are still chary of going into Americans. The Venture Corporation, which floated the company, has been considerably checked in its operations and the Camp Bird deal, of which great things were hoped, has not come off. Of the American companies introduced by the Exploration Company, the Grand Central, of Mexico, has practically suspended operations, owing to the exhaustion of the deposit, but the Tomboy Company has been much more fortunate, owing to the acquirement of an adjoining property of considerable value. The Montana Mining Company is giving up its famous Drumlummon property, owing to its exhaustion, but has acquired other properties and promises to take a new lease of life. The De Lamar Company is also looking out for new properties. The shares of the Utah Consolidated and the Boston Consolidated have not been so prominent in the market as they used to be when first introduced, but the work at the mines proceeds uninterruptedly. The Mountain Copper Company, of Shasta, Cal., is reported here to be within view of the exhaustion of the deposit, though several years' supply of ore remains to be treated. So far no steps have been taken to acquire new properties. The Arizona Copper Company has been placed on an improved financial basis and the plant remodelled on a larger scale, so that the company now is in an excellent position, and the Scotch holders are not at all desirous of parting with their shares. These Mexican properties that have long been before the London public, the Palmarejo, the Mesquit del Oro, and the Parral, have been re-organized and under the new ownership respectively promise to bring returns to the shareholders. A group of claims near Morenci, Arizona, has been introduced to the public under the name of the

Morenci Copper Company, Limited, and though the reports on which they were floated were fairly promising, no results have so far been obtained. As usual a number of wild cats have been trotted round by the bucket shop people, but as none of them are of interest, nor have many subscriptions been obtained, there is no use in specifying them. The success of the Russian oil companies, floated here, has induced promoters to introduce Texas and California propositions to the public, and among them there have been some that are not without promise.

In the British Columbian market, of course, the most important event of the year has been the overthrow of the Whitaker-Wright influence and the acquirement of the control of the Le Roi and other Rossland companies by another city group of operators. At the time of writing, the result of the examination of the properties by Mr. Frecheville has not been received. The shares in Le Roi have seen some wild fluctuations, but the shares in the other companies have been dull and at a low level. It is too early to forecast the market for next year. The most successful group connected with British Columbia is the London & British Columbia Gold Fields, which, under the advice of Mr. S. S. Fowler, have acquired some very fair properties and administered them in miner-like fashion. These properties include the Ymir, the Enterprise, the Whitewater, etc. The Hall Mines, Limited, has been reconstructed, and under the new management the mine has been developed and the smelters have made profits on custom ore, so that the prospects have greatly improved. The Tye Copper Company, working on Mount Sicker, Vancouver Island, has raised further capital to erect smelters so as to avoid the necessity of shipping the ore. The Snowshoe Gold and Copper Company has been floated to acquire the property of that name in Boundary District.

The Mond Nickel Company has been formed to acquire properties in the Sudbury District, in Ontario, and to treat the ores at Swansea by the Mond carbonic oxide process. The Asbestos & Asbestic Company, that was formed a few years ago, to acquire the properties at Danville, Quebec, has not been successful, and the control has this year been handed back to the representatives of the New York interests.

Metallurgical processes have, as usual, been brought before the notice of the investing public this year. The most important is the Elmore process for separating metals and sulphides from gangue by means of petroleum emulsion. Several new processes have also been brought forward for treating mixed sulphides, but the value of none of them has been proved so far. The Swinburne-Ashcroft process is being experimented on at works adjoining those of the Castner Keller Alkali Company, on a commercial scale, so that its value should soon be proved. The Ellershausen process has not progressed at all during the year, owing to hitches in the negotiations with promoters. The Smelting Corporation, which worked the Fry process for treating mixed sulphides, has collapsed, owing to the poor results obtained by the process. An attempt has been made to revive the Smelting Company of Australia, whose operations have been suspended for several years.

#### THE SALT LAKE CITY STOCK EXCHANGE IN 1901.

BY OUR SPECIAL CORRESPONDENT.

The following is a statement of monthly sales made on the Salt Lake City Mining Exchange for the year 1901:

Month.	Shares Gold.	Value of Shares.
January.	739,733	\$551,304
February.	968,060	419,309
March.	1,736,356	731,611
April.	1,854,564	951,539
May.	1,880,575	898,458
June.	1,727,530	1,659,402
July.	2,008,848	1,279,059
August.	1,562,552	1,241,127
September.	1,686,057	1,342,423
October.	2,304,622	1,886,895
November.	1,813,050	1,402,920
December.	1,600,000	1,200,000
Total.	19,881,957	\$13,564,047

The year of 1900 closed with the grand total of 5,156,495 shares sold for \$2,526,809; so that 1901 showed a very large increase in the trading.



DIVIDENDS AND ASSESSMENTS IN 1901.

The dividends paid by 203 mining, metallurgical and allied companies in the United States during 1901 reached a total amount of \$161,699,000, showing a marked improvement over 1900. A large part of these dividends was declared by the industrial combinations from profits realized from an active demand and high prices for the various products nearly throughout the year.

In the group of 123 precious and semi-precious metal mines reporting \$48,351,000, the distribution by 16 copper companies amounted to \$29,895,000; 98 gold, silver and lead properties, paid \$17,772,000; 6 zinc mines, \$552,000, and 3 California quicksilver companies, \$132,000. Copper dividends were less

than last year, owing to the reductions made by the Amalgamated and its subsidiary companies, resulting from the unsatisfactory condition of the metal market in the last half of 1901.

In the industrial list 79 companies paid \$113,348,000, of which 22 iron and steel works contributed \$50,582,000; 33 petroleum and natural gas properties, \$49,507,000; 16 coal and coke companies, \$8,563,000, and 8 chemical and mineral concerns, \$4,696,000. The largest individual payers were the Standard Oil Company, \$46,460,000, equal to 48 per cent on its outstanding capital stock, and the United States Steel Corporation, \$27,968,424, which is at the annual rate of 4 per cent on the issued common and 7 per cent on the preferred stock.

Of the foreign companies reporting to the ENGI-

NEERING AND MINING JOURNAL during 1901 there were 19 Mexican mines that paid \$2,578,000; 4 Central and South American, \$486,000; 8 British Columbia, \$972,000; 2 Nova Scotia, \$415,000; making a total of \$4,451,000 paid by the 33 concerns. The gold silver and lead properties were the most important payers.

Assessments levied by mining companies were larger than last year, owing partly to the increased development work on California properties, notably the oil wells. In all, 217 companies called \$3,045,047 in assessments, of which 112 California concerns collected \$1,522,893; 28 Nevada mines, principally on the Comstock Lode, \$582,424; 65 Utah mines, \$440,730, and 12 South Dakota, gold, Michigan, copper, and properties in other States, \$499,000.

DIVIDENDS—MINING AND INDUSTRIAL.

(\$1.00—\$1,000)

Table with 5 columns: Name of Company, 1899, 1900, 1901, Grand Total. It lists numerous companies and their financial data for the years 1899, 1900, and 1901, along with a grand total for each.

Table with 5 columns: Name of Company, 1899, 1900, 1901, Grand Total. Lists various mining and oil companies with their respective financial data for three years and a grand total.

c.—Copper. g.—Gold. i.—Iron. l.—Lead. q.—Quicksilver. s.—Silver.

ASSESSMENTS.

Large table with 5 columns: Name of Company, 1899, 1900, 1901, Grand Total. Lists numerous companies under the 'ASSESSMENTS' section, providing their financial data for three years and a grand total.

c.—Copper. g.—Gold. i.—Iron. l.—Lead. q.—Quicksilver. s.—Silver.



## MINERAL RESOURCES OF EGYPT

The Egyptian Mines Exploration Company, a London organization, is now engaged in reopening some of the ancient gold mines of the Eastern Desert, between the Nile and the Red Sea in Egypt. In a paper on the exploration of this region, in connection with that company's work, Mr. C. J. Alford\* considers the gold mining question at length, and believes that there are fair prospects of success.

Mr. Alford also says that in addition to gold, several other valuable mineral products have been discovered in these eastern districts of Egypt. At Jebel Jassus, about 2 miles south of Safaga Bay, on the Red Sea, are some ancient mine workings in a steep hill of crystalline limestone. The strata of limestone are sharply tilted up from the east and the adjacent country generally disturbed, with large accumulations of pebble drift in the valleys and masses of sand towards the sea. The whole side of this hill is covered with old workings, which appear to have penetrated to a bed of indurated limestone, which occurs a few feet below the surface, and which carries impregnations of galena. Almost every trace of this ore has been removed by the old workers, so it is difficult now to ascertain what this bed ever contained. A sample of galena was, however, collected by chipping small pieces from the limestone wherever any of the ore could be seen, and this, roughly concentrated, gave an assay: Lead, 50 per cent; gold, 0.1 ounce, and silver, 3 ounces per ton. The Bay of Safaga, at the foot of the wady, is said to be an excellent harbor, but it is never now made use of, and there are no inhabitants or buildings in the neighborhood. A route from here leads down the coast, about 40 miles, to Kosseir, a somewhat important harbor, from which a native trade is carried on in corn and other commodities with the Arabian coast of the Red Sea.

About 90 miles west-southwest from Luxor, and 50 miles from the Red Sea coast, near the ruins of the ancient settlement of Abu Geraia, are some extensive and most interesting ancient marble quarries, 1 mile north of Wady Mia. Here an outlier of limestone on the granite has been converted into a beautiful white statuary marble, by the intrusion of dikes of felsite and greenstone—the latter penetrating the marble mass and the former adjacent to, and in contact with it, on the west side. Enormous heaps of chippings show that the marble had at one time been extensively worked, but, with the exception of one fragment of a broken vase, no worked pieces have been found. The neighboring country is generally talc schist and gray granite, and the occurrence of this marble mass at so great a distance from any rock of its kind is an interesting geological problem. For years Egyptologists have been puzzled by the existence in many ancient buildings throughout Egypt of a white crystalline marble of great purity and beauty, the original source of which was quite unknown. Here at last the long-sought marble was found. Unfortunately, the distance of the quarries from the Nile renders the cost of transport, which at present has to be done entirely by camels, so high that in spite of its superior quality this marble has little chance of competing in the market with that from Europe.

In the winter of 1899-1900 an expedition was sent out by Messrs. Streeter & Co. to explore the ancient emerald mines of Jebel Zabara, some 80 miles south of Um Rus, and 25 from the excellent little harbor of Sherm Sheik, on the Red Sea coast, and encouraging results were obtained. It is to be regretted that these explorations have not been continued, as it is certain that in ancient days these Zabara mines produced emeralds of the finest quality and in large quantities. The emeralds are found associated with great quantities of beryl in a matrix of mica schist, a large zone of which appears from under the Nubian sandstone to the westward of Jebel Nihari, south of the Hamesh gold mines, and from there extends eastward to Jebel Zabara and the sea. There is also another zone of micaceous and talcose rocks, in which

emeralds might possibly be found, to the north of Eridia, eastward of Kench.

Turquoise is being worked by the Egyptian Development Syndicate in the peninsula of Sinai. It usually occurs lining cavities and fissures in the Nubian sandstone, and varies greatly in value according to color and hardness. Some small specimens were found by the writer in the neighborhood of Eridia.

Deposits of phosphate of lime occur, associated with limestones of Cretaceous age, to the eastward of Kench, on the right bank of the Nile; also there are some large deposits of the same on the coast of the Red Sea about Kosseir, which will probably be found to extend parallel to the coast for 60 or 70 miles. These have been to some extent sampled and reported on by Mr. Frank Western, and show results warranting an exhaustive and systematic exploration.

**TREATMENT OF EXHAUSTED CYANIDE SOLUTIONS.**—A method, in part electrolytic, for the regeneration of fouled cyanide solutions, is covered by a patent recently issued to William Orr, of Salt Lake City, Utah. The dilute cyanide solution employed for the extraction of gold from ores or tailings is extremely sensitive, its solvent power varying widely under different conditions of concentration and temperature, depending largely on the free access of oxygen, and decreasing to marked degree under the influence of dissolved base metals. In use these solutions become quickly weakened from the presence of copper and zinc, the former derived often from the ores, and the latter from the precipitation vats, and both existing in the form of double cyanides which are without solvent action on gold. If zinc alone be present the fouled solutions yield readily to known methods of treatment, but in the presence of both copper and zinc the familiar chemical reactions fail, owing probably to the formation of complex ions not susceptible of direct precipitation by the usual reagents. Solutions of this character are electrolyzed, according to the new method, with anodes of zinc and cathodes of copper, whereby the copper separates out in metallic form and the zinc of the anode enters into solution as a cyanide, replacing the corresponding copper salt. After this preliminary treatment the solution is rendered alkaline by a mixture of sodium and calcium hydrates and the zinc thrown down as sulphide, care being taken to avoid excess of the precipitant. The solution, thus restored as regards its content of free cyanide, is returned to the ores.

## PATENTS RELATING TO MINING AND METALLURGY

## UNITED STATES.

The following is a list of patents relating to mining and metallurgy and kindred subjects, issued by the United States Patent Office. A copy of the specifications of any of these will be mailed by the ENGINEERING AND MINING JOURNAL upon receipt of 25 cents.

Week Ending December 17, 1901.

- 688,860. CHUCK FOR ROCK DRILLS.—James Kay and Charles T. Wearne, Minton, Canada. A rock-drill chuck comprising a body provided with a taper key-passage which communicates with a tapered bushing and with an external groove, a tapered and grooved drill-shank adapted to said bushing, a tapered key fitted in the taper passage of the body for engagement with the grooved face of the drill-shank, and a spring-band having the openings and fitted in the external groove of the chuck-body.
- 688,861. ELECTRIC FURNACE.—Charles A. Keller, Paris, France. An electric furnace comprising a fusion-hearth provided with cavities, two electrodes inclined toward the fusion-hearth provided each with a tongue entering one of the said cavities, these electrodes being mounted on wheels running upon rails, and connected by means of cables bearing upon return pulleys and passing around a drum provided with a hand-crank, the said fusion-hearth being likewise mounted on wheels running upon rails disposed perpendicularly to the said rails of the said electrodes.
- 688,872. METHOD OF MAKING SULPHURIC ACID.—Theodore Meyer, Offenbach, Germany, assignor of one-half to Charles Glaser, Baltimore, Md. The method consists in imparting to the gases of which the sulphuric acid is made, a circular, spiral volute motion within a chamber, the gases being introduced at the top, and withdrawn from the bottom of the chamber, whereby the bases are intimately mixed,

active chemical action is caused, and they are cooled by contact with the external walls of the chamber.

- 688,873. ELECTRIC MINING MACHINE.—Edmund C. Morgan, Chicago, Ill., assignor to the Morgan Electric Machine Company, Chicago, Ill., a corporation of Illinois. A main frame having a rack-bar, an auxiliary frame mounted to move upon said main frame, a feed-shaft journaled in said auxiliary frame and having a gear arranged to mesh with said rack-bar, a worm-block and a bevel-gear loosely sleeved upon said shaft, a counter-shaft mounted in said auxiliary frame and having a worm-gear thereon arranged to mesh with said worm-block, a worm-wheel geared to said bevel-gear and also meshing with and driven from said worm-gear, a motor mounted on said auxiliary frame and arranged to drive said counter-shaft, and means for independently coupling said worm-block and bevel-gear to said feed-shaft.

- 688,910. MANUFACTURE OF CEMENT OR SIMILAR MATERIALS.—George Warren, Iford, England. The process consists in forming the materials into a liquid sludge separating and confining portions of the sludge while in liquid condition, drying said separated portions of the sludge to form blocks, and burning said blocks.

- 688,932. PROCESS OF PRESERVING WOOD.—Octave Chanute, Chicago, Ill. The process consists in subjecting wood first to a solution of chloride of zinc, then to a solution of tannin, and finally to a solution of gelatin.

- 689,017. METHOD OF REGENERATING WASTE CYANIDE SOLUTIONS.—William Orr, Salt Lake City, Utah, assignor to the Gold and Silver Extraction Company of America, Limited, Denver, Colo., a joint stock company of Great Britain. The method of regenerating, for subsequent use in the extraction of precious metals by processes employing a zinc precipitant, cyanide solutions fouled or reduced to waste by the presence of the double cyanide of zinc and potassium, which consists in first introducing into such solution alkaline hydrate in quantities sufficient to release from its combination with the zinc in solution the amount of cyanide of potassium required to be restored as free cyanide and to secure the dissociation of a sufficient quantity of said double cyanide to insure thereafter the complete combination with said last-mentioned zinc of all the sulphide added as hereinafter described, next agitating the solution until the hydrate has been brought into contact with said double cyanide, resulting in a zincate and free cyanide of the alkali, next, introducing into the solution soluble alkaline sulphide in amount less than required to precipitate all said zincate, next, further agitating the solution until said zincate has been brought into contact with said sulphide, and the latter precipitated, and finally removing the resulting zinc-sulphide precipitate.

- 689,018. METHOD OF RECOVERING CYANIDES.—William Orr, Salt Lake City, Utah, assignor to the Gold and Silver Extraction Company of America, Limited, of Denver, Colo., a joint stock company of Great Britain. The method of regenerating cyanide solutions which have become fouled owing to the presence of double cyanide of zinc and potassium, which consists first in introducing into such solution alkaline hydrate, being hydrate of the monovalent alkali metals and hydrate of the divalent alkali-earth metals in the proportion of about two of the hydrate of the monovalent alkali metals to one of the hydrate of the divalent alkali-earth metals, next, after the dissociation of the said double cyanide by the hydrate, in introducing into the solution soluble alkaline sulphide and finally removing the resulting zinc-sulphide precipitate.

- 689,065. DIFFERENTIAL PUMP.—Edwin M. Coryell, New York, N. Y., assignor to Julia E. Cameron, New York, N. Y., proprietress of the A. S. Cameron Steam Pump Works. The combination with a pump-cylinder having a suction-valve at its bottom and a discharge at its upper end, of a differential plunger consisting of a hollow upper portion closed at top and open at bottom and an open-ended shell constituting the lower portion and closed at its bottom by a lifting-valve, said two portions being connected together by means of ribs located interiorly of said portions so as to permit free communication between their interiors and the pump cylinder, and the available displacement of said upper portion being substantially one-half the volume contained within said shell.

- 689,070. SEPARATING MINERAL SUBSTANCES BY THE SELECTIVE ACTION OF OIL. Alexander S. Elmore, London, England. A process for separating metallic and rocky constituents of ore which consists in mixing pulverized ore with water and mixing the ore and water with oil in the presence of an acid, allowing the mixture to rest whereby the oil having the metallic substances entrapped in it floats at the top of the mixture, and separating the metallic constituents from the oil.

- 689,083. COLD STEEL OR IRON SAWING MACHINE.—Joseph Hill, Derby, England. The combination, with a base, and a rotary standard pivoted on the base, of a driving shaft, mechanism connecting the cutter-shaft with the driving shaft.

- 689,129. MANUFACTURE OF REFRACTORY MATERIALS FOR BUILDING OR OTHER PURPOSES.—Alfred G. Salamon, London, England, assignor to the British Uralite Company, Limited, London, England. A process of agglomerating permeable fire-resisting material, consisting in impregnating the same with a solution of a soluble silicate and afterward acting upon the said material with a solution of calcium bicarbonate.

\*Institution of Mining and Metallurgy, London, October, 1901.

- 689,147. APPARATUS FOR DEEP BORING.—Joseph Vogt, Niederbruck, near Massevaux, Germany. The combination with a beam mounted to oscillate, of a rigid boring-rod resting freely upon said beam and having a boring tool permanently secured to its lower end, a plate in which said boring-rod is mounted, and a plurality of springs arranged between said plate and beam.
- 689,166. MINING APPARATUS.—John E. Coleman, Spokane, Wash. In apparatus for recovering rare or precious metals and the like, the combination of a chamber or vessel adapted to receive metal-bearing sand, gravel, earth or the like, and water; and a siphon communicating with said chamber or vessel above the intake and having its outlet or delivery end at such level relatively to the intake as to cause a lifting by unaided siphonic action of all particles or bodies of less than pre-determined specific gravity, and thereby to effect a separation of particles of bodies in said chamber according to their relative specific gravity.
- 689,167. ART OF METHOD OF MINING.—John E. Coleman, Spokane, Wash. The method of effecting separation of bodies of different specific gravity, which consists in mixing the same with a suitable liquid, agitating the mass, and applying suction to the upper part of the mass by means of a siphon, the intake and outlet of which are located at such relative levels as to cause the siphon-current to carry off all matters of less than predetermined specific gravity and to leave behind all others.
- 689,183. COAL SEPARATOR.—Patrick F. Haran, Scranton, Pa., assignor of seven-twelfths to John R. Richardson, Scranton, Pa., and Edward G. Cotton, Wilkesbarre, Pa. The combination with side pieces and floor constituting a chute, of a second chute, and an inclined controlling member underneath the chutes and provided with an upwardly-curved and longitudinally slotted transverse portion intermediate of the chutes and extending above their bottom walls.
- 689,190. PROCESS OF PRECIPITATING AND RECOVERING PRECIOUS METALS FROM THEIR SOLUTIONS.—Bertram Hunt, San Francisco, Cal. A process of precipitating precious metals from a cyanide solution consisting of adding to said solution finely-divided metal aluminum, then adding mercury to the pulp and agitating the pulp until the metal is in the form of an amalgam, and finally recovering the metal by treating the amalgam.
- 689,199. ELECTRODE.—Thomas B. Kinraide, Boston, Mass. An electrode having a discharge-point, and means for electrically screening said point for limiting the tendency thereof to discharge.
- 689,219. STAMP MILL.—William E. Parnall, Calumet, and Charles H. Krause, South Linden, Mich. The combination with a single stamp provided with a detachable hardened shoe and a mortar having a cavity provided with a removable hardened die and hardened stave liners constructed and arranged to receive the impact of the pulp and to direct the same upwardly and outwardly on all sides, of a removable cylindrical screen surrounding the stamp concentrically therewith so as to be approximately perpendicular to the direction of the splash passing through it on all sides of the mortar, and a removable splash-pan surrounding said screen and open at the bottom so as to intercept the pulp passing through said screen and to afford a free and constant discharge therefor.
- 689,246. PROCESS OF PURIFYING GAS.—Edward Theisen, Baden Baden, Germany. The process consists in causing liquid to flow over a series of stationary surfaces, introducing gases into the apparatus and producing an energetic reciprocal action between the gas and the liquid by means of centrifugal section.
- 689,252. ORE CONCENTRATOR.—Herman Unzicker, Chicago, Ill. The combination of a stationary frame provided with bearings, a tiltable frame provided at its ends with central stubs journaled in said bearings, said bearings permitting longitudinal movement of said tiltable frame, adjustable means securing said tiltable frame at a given angle of transverse inclination, a belt carried by said tiltable frame, a transversely extending shaft, means for communicating reciprocating motion from said shaft to said tiltable frame, and means for imparting motion to said belt.
- 689,272. BLOWING ENGINE.—Armand Bailly, Seraing, Belgium. In combination a cylinder and piston, inlet and outlet valves, a supplemental outlet valve controlling a part leading from the end of the cylinder and governor means controlling the said supplemental valve to open the same during the first part of the stroke of the piston when the pressure exceeds the normal and to close the same during the final part of the stroke of the piston to allow the same to compress the air.
- 689,275. PROCESS OF REMOVING ZINC FROM LEAD.—Thomas Barton and Thomas B. McGhie, London, England. A process of purifying metallic lead, containing zinc, consisting in heating the metals to the melting-point, converting the zinc into a zinciferous product by the action of fused caustic alkali in the presence of oxygen, and finally separating said zinciferous product from the lead.
- 689,279. STEAM-STAMP.—Edward S. Brett, Coventry, England. In a steam-stamp the combination of the engine having a rotative shaft, pulley and arms with a lifting-pulley rope and hammer-head.
- 689,286. MANUFACTURE OF SOLUBLE PHOSPHATES.—Guillaume De Chalmot, Leaksville, N. C., assignor to Wilson Laboratory Company, New York City, N. Y., a corporation of West Virginia. A process of treating natural

phosphate for increasing the proportion of soluble phosphoric acid, consisting in mixing the same with silica, fusing the mixture in an electric furnace, removing it from the furnace as fast as it becomes molten, and then bringing the heated material into contact with a further quantity of silica.

- 689,346. MINE-DOOR.—John C. Young, Monessen, Pa., assignor of two-thirds to Lute Hornickel, Monongahela, Pa. Doors arranged diagonally of the entry and opening in opposite directions, and mechanism for opening and closing said doors.
- 689,360. CRUSHER.—William E. Johnson, Joplin, Mo. In a crusher, a fixed jaw, a swinging jag, a shaft, an eccentric on said shaft, a pitman engaging with the eccentric, a thrust-block engaging with the movable jaw, a wedge arranged between the thrust-block and the pitman, and a swinging support for said wedge, said support being adjustable.
- 689,366. DEVICE FOR SEPARATING GAS FROM WATER AND OIL.—Clarence Newbold and Albert Lowry, Elwood, Ind.; said Newbold assignor to said Lowry. In a separator for gas, water and oil, the combination with two receivers having inlet and outlet pipes, of a connection at the top, and a connection at the bottom, the receiving-drum connected to the latter.
- 689,367. MINER'S SQUIB.—Henry J. Richards, Wilkesbarre, Pa. A miner's squib comprising an igniting-tube, and an adjustable match on said tube.

#### PERSONAL.

Mr. John E. DuBois has returned to his home in Pennsylvania from his Utah properties.

Mr. Samuel Newhouse has arrived in Salt Lake, Utah, and will look into his various Utah mining interests.

Mr. Thomas Weir recently returned to Salt Lake, Utah, from Colorado, where he has been on a visit for a few weeks.

Mr. R. J. Cory, manager of the Allis-Chalmers Company's Denver office, has returned to Denver from Mexico and Arizona.

Mr. W. S. McCormick, Mr. J. E. Bamberger and Mr. David Keith recently returned to Salt Lake, Utah, from New York City.

Mr. Victor M. Clement has returned to Salt Lake, Utah, after devoting about a month in Mexico to his mining interests in that republic.

Mr. George J. Rockwell, metallurgist of the Allis-Chalmers Company, has returned to Chicago, Ill., from a professional trip to Arizona.

Mr. Leo Von Rosenberg, of New York City, sailed from San Francisco on December 23 for Mazatlan, Mexico, to examine several mines in Sinaloa.

Mr. John Gillie, superintendent of the Butte & Boston mines, at Butte, Mont., has been appointed superintendent of all the mines of the Amalgamated Copper Company.

Dr. James Douglas, president of the Copper Queen Mining Company, recently delivered a lecture to the students in metallurgy at the Columbia School of Mines, New York City.

Mr. W. L. Ayres, mining engineer of Hazleton, Pa., who was in Newfoundland on an important professional engagement, from July to December, 1901, has returned to his home in Hazleton.

Mr. L. Maurice Cockerill, of London, Eng., has been appointed manager of the United Mexican Mines Association, Limited, at Guanajuato, Mex., succeeding Mr. Richard Hy. Williams, who resigned some months ago.

At a recent meeting of the Illinois Steel Company, one of the subsidiary corporations of the United States Steel Company, Mr. T. W. Robinson was elected first vice-president and Mr. F. H. Foote was elected second vice-president. Mr. C. H. Foote, formerly the first vice-president, has retired.

#### OBITUARY.

Edward W. Meloy, a prominent citizen of Strullsburg, Wis., died recently at his home in that city at the age of 87 years.

George D. Roberts, one of the best known mining men in California and the West, who had been connected with the development of several of the celebrated mines, died December 24, after a short illness in New York City. He was 73 years old. Mr. Roberts was born in Kentucky. In 1852 he went out to Grass Valley, Cal., and started the first newspaper of that section. He was also the first to start quartz mining there. In 1869 he went to Virginia City, Nev., and soon afterward became engaged with others in the development of the Comstock Lode, in which he is said to have made a fortune.

#### SOCIETIES AND TECHNICAL SCHOOLS.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.—This society will hold its annual convention at Joliet, Ill., January 22, 23 and 24.

#### INDUSTRIAL NOTES.

The Baldwin Locomotive Works, of Philadelphia, Pa., has secured a locomotive order from the Hilo Railway, Hawaiian Islands.

The Keystone Driller Company, of Beaver Falls, Pa., is reported to have recently secured 2 contracts for drilling machines for testing placer ground on the Gold Coast, West Africa.

The Bethlehem Steel Company, of South Bethlehem, Pa., has an order from the American Bridge Company for what will be the largest eye bar machine in the world. It will have a capacity for making 16-in. eye bars.

The contract for the machinery for the copper smelting and concentrating plant, to be built at once by the Calumet & Arizona Mining Company, at Douglas, Ariz., has been awarded to the Allis-Chalmers Company, of Chicago, Ill.

The American Hoist and Derrick Company, of New York City, has received an order from the Atlantic, Gulf & Pacific Company, of New York City, for hoists and derricks to be used in connection with the improvement of Manila Harbor.

Among the other orders received by the Salt Lake Hardware Company, of Salt Lake, Utah, during a recent week was one from the Mount Lyell Copper Mining Company, Kelly Basin, Tasmania, the machinery to go by way of San Francisco.

The De Beers Consolidated Mines, Limited, of Kimberly, South Africa, has placed a contract with the Cincinnati Milling Machine Company, of Cincinnati, O., for the shipment of several milling machines, to be installed in the machine shops of the De Beers mines.

The Norton Emery Wheel Company, of Worcester, Mass., has its Niagara Falls plant running full blast, and car-loads of artificial corundum have been delivered at Worcester and made into corundum wheels. The demand for this artificial corundum from other manufacturers of abrasive wheels is reported large.

The A. Wyckoff & Son Company, of Elmira, N. Y., says that it is receiving many flattering testimonials from mine operators as to its wood pipe. The Brazil Mining Company, of Brazil, Ind., says that pipe bought July, 1900, has given entire satisfaction, though the water was so bad that it would eat up iron pipe in 2 months.

Messrs. Browne & Frothingham, of 32 Broadway, New York City, have opened a department for the export of machine tools. This department will be under the supervision of Mr. A. M. Fisher, who has returned from a 3-years' stay in Japan. The firm solicits correspondence with the purchasers of machine tools in foreign countries.

Messrs. E. H. Sargent & Co., of Chicago, Ill., dealers in chemists and assayers' supplies, announce that they have purchased the stock and goodwill of Richards & Company, Limited, of Chicago, transfer having taken place on January 1. The company's stock will, therefore, be greatly enlarged, and its business pushed with new vigor on a much larger scale than heretofore.

On application of representatives of a majority of the bondholders of the Asphalt Company, of America, Henry Tabnall, John M. Mack and John F. Shanley have been appointed receivers for the National Asphalt Company and the Asphalt Company of America. President Francis V. Greene stated that while earnings during the present year, in spite of competition and international difficulties in South America, have been very large, they are not equal to fixed charges.

The Western Electrical Supply Company, of St. Louis, Mo., has recently enlarged its railway and mining department, and now carries a large general stock of mining apparatus and supplies. The firm is handling a very complete line of generators, motors, electric locomotives, electric drills, pumps and general supplies of every description and states that it is in a position to furnish promptly anything pertaining to the electrical operation, equipment or maintenance of mines and mills.

On January 1, 1902, the Bullock Electric Manufacturing Company, of Cincinnati, and the Wagner Electric Manufacturing Company, of St. Louis, established a foreign sales department, with headquarters at Cincinnati, O. Hereafter all foreign business, except in Mexico and Canada, for the 2 companies, will be handled by this new department, which will be under the management of Frank G. Bolles. The work of the advance department will continue under the direction of Mr. Bolles, under whose charge it has been for the past 3 years.



The National Portland Cement Company, of Durham, Ont., now has 9 large buildings under construction. The marl in Wilder's Lake, 4 miles away, said to contain over 90 per cent of carbonate of lime, is to be used, and there is sufficient clay in the immediate vicinity. Other lakes, at short distances, show large deposits of marl, and several of the deposits are at or near the surface. The capacity of the mill is to be 1,200 bbls. daily, and the company is giving employment to 175 men on construction. A branch line 4 miles in length, is nearly completed for material, and all the machinery is of latest type.

A consolidation of 25 companies said to control the principal gypsum fields of the United States has been effected at Chicago, and incorporation papers of the United States Gypsum Company have been filed in Trenton, N. J. The company has a capital of \$10,000,000. Its avowed purpose is to develop the use of gypsum in the manufacture of plaster as against that of lime. The management of the combination will remain in the hands of the leading men of the combining companies. The principal offices of the company will be in Chicago with distributing branches in Omaha, St. Louis and Buffalo.

The Herron & Bury Manufacturing Company, of Erie, Pa., composed of James H. Herron and Edmund Bury, has completed a fully equipped plant for the manufacture of air compressors. The firm will make belt, electric, water-wheel and steam driven types. Mr. Herron was for years draughtsman for the Erie City Iron Works, and the past 3 years chief draughtsman for the Cambria Steel Company, of Johnstown, Pa. Mr. Bury after 6 six years with Erie City Iron Works and 2 years with Fraser & Chalmers, of Chicago, was 4 years assistant foreman with the Ingersoll-Sergeant Drill Company.

The American Diesel Engine Company is preparing for its plant at Worcester, Mass. The company has placed large orders for machine tools, including an order for lathes of the F. E. Reed Company, of Worcester. Altogether, \$50,000 will be spent in putting the Worcester plant in shape for building the engines. Some of the new machinery has already been delivered, and in a few weeks it is expected the shop will begin work on its special tools. By spring it is believed that over 100 persons will be employed. The castings for the machines will be furnished at first from the Providence foundries controlled by the International Power Company.

The Hardy Motor Works has been organized at Port Huron, Mich., to manufacture gasoline engines. The capital stock is \$30,000, and the stockholders are R. E. Hardy, W. L. Jenks, F. A. Peavey, T. A. Goulden, G. F. Conner and F. J. Watt, the latter being mechanical superintendent. R. E. Hardy was president and manager of the Detroit Motor Works, and prior to that was secretary and treasurer of the Olds Gasoline Engine Works, of Lansing, Mich. He will be general manager of the new company. The company acquires all rights, patents, pattern drawings, etc., in the Hardy gasoline engine recently put on the market by the Detroit Motor Works.

Among the recent contracts for bridge work taken by the American Bridge Company, of New York City, are 2 structures for the Wabash Railroad's entrance into Pittsburg, Pa. These bridges are both cantilevers, 1,504 ft. total, length with a center span of 812 ft.; they carry 2 tracks and the eye-bars will be the largest ever manufactured in this country. One bridge is over the Allegheny River at Pittsburg and the other is at Mingo Island. The Company has also taken an order for a bridge across the Ohio River at Marietta, made up of 2 220-ft. spans, 1 1,380-ft. cantilever span a viaduct approach of 645 ft. This structure is for highway and electric railway purposes.

Fox Brothers & Co., of New York City, are reported to have secured a contract for the complete equipment of a 21-mile railroad about to be constructed in Chile. About 800 tons of 60-lbs. rails will be required. Two 35-ton locomotives are to be built at the Baldwin Locomotive Works, Philadelphia. Thirty freight cars, 28 ft. over all, 5½ ft. wide and 3½ ft. gauge, will be made by the Allison Manufacturing Company, of Philadelphia. The car wheels are to be furnished by the Roberts' Car Wheel Company, of Three Rivers, Mich. The Blake branch of the International Steam Pump Company, of New York City, is to furnish two pumping plants, and W. E. Caldwell, of Louisville, Ky., is to forward 2 large water tanks. The construction tools, it is said, are to be supplied by Fox Brothers & Company.

The General Electric Company, of New York City, has secured a blanket contract, valued at about \$750,000, for an electric railroad in Tokio, Japan, covering everything outside the piping, valves and fittings, rails and car bodies. The General Electric contract calls for three 1,200-kw. generators, also 6 rotaries of 400 kw. each. Contracts for the following material they have sublet: Three 1,800-h. p. cross compound horizontal McIntosh-Seymour engines, and 8 350-h. p. Babcock & Wilcox boilers. The Blake branch of the International Pump Company will build the pumping and condensing equipments, comprising 3 main con-

densing outfits, 1 pump for the exciter engine, 2 feed pumps and some small equipments. The heaters will be of the Wainwright type. The 250 car trucks will be made by the Peckham Manufacturing Company, of New York City. The double motor equipment will be of General Electric build. The Morgan Engineering Company, of Alliance, O., is to build a 20-ton electric crane. The order for piping, etc., has been allotted to Mann & Taylor, of New York City. The road will, it is thought, be ready early in 1903.

The Crocker-Wheeler Company, of Ampere, N. J., says that the year just closed has been a very prosperous one. The company reports a record-breaking mid-winter business, and finds it difficult to keep production up to demand. The following are some of the recent shipments: Two 400-k. w. generators to the Vandergrift Construction Company; one 300-k. w. generator to Stetson & Company, of Philadelphia; one 150-k. w. generator to the D'Olier Engineering Company, of West Camp, N. Y., and one 40-k. w. generator and 28 motors to the Smith-Brooks Publishing Company plant, in Denver, Colo. The United States Tube Company, of Buffalo, N. Y., has been supplied with a motor equipment, and the electrical equipment of the Con. P. Curran printing establishment in St. Louis, Mo., which takes the place of line shafting, has been completed. Orders for a large number of motors have been received from Armour & Company, the American Bridge Company, and the Marion Steam Shovel Company. An order for a 30-k. w. special generator has been received from the Sultan of Linga. The machine is to be installed in his royal palace, on an island near Singapore.

The Loomis-Pettibone Company, of 52 Broadway, New York City, is reported to have secured a concession from the Government of Nuevo Leon, Mexico, for the construction of a \$500,000 gas plant at Monterey. The plant is intended to produce gas for both illuminating and fuel purposes. The concession is said to be for 50 years, and permits the laying of pipes along the city streets. In addition, the New York company, it is stated, proposes to arrange to furnish power direct from the general plant to manufacturing plants in Monterey. R. N. Oakman, chief engineer of the Loomis-Pettibone Company, is in Mexico to determine as to the exact requirements in the way of material needed. It is said that 5 miles of pipe will be required. The Guggenheim Exploration Company, of Santa Barbara, Mexico, has placed a contract with the Loomis-Pettibone Company for the shipment of a 500-h.p. gas plant for general power purposes at its mines. The engine portion of the contract is to be executed by the Otto Gas Engine Company, of Philadelphia, Pa. The National Iron and Steel Works, of Mexico City, is to install a 700-h.p. gas plant, built by the Loomis-Pettibone Company, and 7 Westinghouse gas engines.

The Henry S. Mould Company, of Pittsburg, Pa., says that smelter managers are coming to recognize the value of the White briquetting press for putting fine ores, flue dust, concentrates and slimes into solid block form, and the demand for the machines is increasing at a rapid rate, both in the United States and abroad. During December, the company shipped White briquetting presses to the following firms: The Allis-Chalmers Company, for the Backus & Johnson Company, of Lima, Peru; the Kendrick & Gelder Smelting Company, of Silverton, Colo.; the Granby Consolidated Smelting, Mining and Power Company, of Grand Forks, B. C.; the United States Mining Company, of Salt Lake, and a second outfit to the Bingham Copper and Gold Mining Company, of Salt Lake City. The machines have come into use in Australia and Tasmania, and the Pittsburg manufacturers have established briquetting plants at a number of smelters, among them being the Broken Hill Proprietary Company, Port Pirie, N. S. W.; the Mount Lyell Mining and Railroad Company, at Mt. Lyell, Tasmania; the Tasmania Smelting Company, at Zeehan, Tasmania, and the Smelting Company, of Australia, Ltd., at Oapto, Lake Illawarra. The Australian agents of the Henry S. Mould Company are Knox, Schlapp & Company, of Melbourne. The home office of the company is in the Empire Building, Pittsburg, Pa.

#### TRADE CATALOGUES.

The Holtzer-Cabot Electric Company, of Brookline, Mass., publishes a neat little pamphlet giving a long list of users of the Ness automatic intercommunicating telephone system. These users comprise banks, hotels and many industrial concerns, including one company in Japan. The system is intended for interior work, bringing all departments of a large establishment in prompt communication.

Brighton gas and gasoline engines are described at some length in an attractive 39-page pamphlet, published by the Pierce-Crouch Engine Company, of New Brighton, Pa. These engines are stated to be built on the straight-line principle, with auxiliary piston valve, self-oiling phosphor-bronze bearings and an automatic starter. The engines above 6 h. p. are

equipped with both incandescent tube and electric spark igniters.

An address on "Compound Locomotives," delivered before officers and employees of the Union Pacific Railroad, by S. M. Vauclain, is reprinted as No. 30 of the "Record of Recent Construction" of the Baldwin Locomotive Works of Philadelphia, Pa. The pamphlet describes the development of the Vauclain type of compound locomotives and is interesting reading. One cut taken from a photograph at Newchwang, China, show a Baldwin compound locomotive on the Chinese Eastern Railway.

Circular No. 61, sent out by the Bristol Manufacturing Company, of Waterbury, Conn., describes Bristol's recording thermometer. These thermometers are graduated for various ranges of temperatures, and are for dry-kilns, ovens, closed spaces, hot blasts, chimney gases, liquids, and gases in pipes, feed water for steam boilers, or for hotels, greenhouses and private residences, etc. The recording apparatus is connected, by a small flexible copper tube with a bulb partly filled with alcohol, that gives variations of pressure according to temperature.

Electric locomotives for manufacturing establishments are described in pamphlet No. 0113, published by the C. W. Hunt Company, of New York City. These locomotives are of the storage battery type, and are mounted on 2 swivelling 4-wheel trucks, each wheel a driver, enabling the locomotives to surmount heavy grades and run around curves of 12 ft. radius. The driving mechanism is stated to be entirely closed, so that the locomotives can run through 6 in. of water without wetting any running part. The current required at 5c. per h. p. hour will, it is estimated, cost from 30 to 100c. per day of 10 hours, for the type described.

Engineering and astronomical instruments are described in a 112-page pamphlet, issued by George N. Saegmuller, of Washington, D. C. In the meridian described, it is stated that by the use of improved graduating instruments graduations are obtained with each line correct within 1 second of arc. The engineer transits are graduated either into ½-degree spaces, reading to single minutes by the vernier, or the circle is graduated into ⅓-degree spaces, reading to half-minutes by the vernier. These transits may be had with the Saegmuller solar attachment for obtaining with quickness and precision the astronomical meridian, and with a new quick-levelling tripod head with shifting plate. A new vertical sighting prism is made for use in mining transits. These transits are listed at from \$170 to \$300. The Saegmuller instruments include astronomical telescopes, transits and meridian circles and engineers' transits and levels, also rods, tapes and chains.

#### GENERAL MINING NEWS.

##### ARIZONA.

###### COCONINO COUNTY.

(From Our Special Correspondent.)

*El Capitan.*—Superintendent Wombacher, of Jerome, reports the ore shoot as being 75 ft. wide, averaging 18 in. thick.

###### GRAHAM COUNTY.

(From Our Special Correspondent.)

*Mammoth Collins.*—This mine, near Florence, is to be worked by a new company with Geo. P. Blair as general manager.

###### MARICOPA COUNTY.

(From Our Special Correspondent.)

Redmond Toohy and Stephen A. Dorsey, of New York City, have been in Phoenix. Mr. Toohy is to transfer a group of gold claims in Harqua Hala District to Mr. Dorsey, who is largely interested in mining in the territory.

###### MOHAVE COUNTY.

(From Our Special Correspondent.)

*Empire.*—E. F. Thompson and G. W. Beecher, of Kingman, have agreed to sell this mine to H. B. Eakins. The price has not been made public.

*Grand Gulch.*—This mine, which is just across the Utah-Arizona line, sent forward to the Salt Lake Valley smelters 63,780 lbs. of high-class copper-gold ore for the week ending December 21.

###### PIMA COUNTY.

(From Our Special Correspondent.)

*Gold Mountain.*—This mine is reported to show a shoot of gold ore 600 ft. wide, almost the whole length of the claim and is cut to a depth of 200 ft. by a box canyon. Thirty men are busy.

##### CALIFORNIA.

###### ALPINE COUNTY.

(From Our Special Correspondent.)

*Curtz-Evans Mining and Milling Company.*—At Loope, this company, Capt. Peter Curtz, manager

and A. C. Kingsbury, assistant, is working 40 men and a 10-stamp mill. Concentrates and the richest ores are sacked and shipped to the Selby Smelting Works. In the spring electric power will be generated on the Carson River and transmitted to the mine and works. This is the first time in years that any mining has been done in Alpine County.

## AMADOR COUNTY.

(From Our Special Correspondent.)

**Bucna Vista.**—At this copper mine near Ione, roads are being graded, and buildings put up. The copper ore carries some value in gold and silver.

**Mountain Queen.**—A strike of good ore is reported in this mine at Pine Grove by B. W. Pitts and H. F. Burtreth.

**Peerless.**—Operations are temporarily suspended, there being a difference of opinion as to the best method of prospecting.

**Wyona.**—Another strike is reported from this mine, near Plymouth owned by Dr. Boyeson.

## CALAVERAS COUNTY.

(From Our Special Correspondent.)

**Altaville Mining Company.**—This company has been organized by Alex. Chalmers, of Angels; C. Demarest, F. J. Solinsky, of San Andreas, and H. E. Adams, of Stockton. The R. B. Pryal Mine, which the company is to work is in Altaville, near Angels, and a contract has been let by C. Chalmers, manager of the Lightner, at Angels, to sink a 2-compartment shaft.

**Fannie Marie Gold Mining and Milling Company.**—The property at Glencoe is being opened by Geo. W. Brown, of Boston, with F. O. Cortinash, as superintendent. Thirty men are employed.

**Hex.**—These mines, at Rich Gulch, owned by R. W. Petrie, have been sold to James O. Stewart, superintendent of the Anglo-Saxon Gold Mining and Tunnel Company, and developments will start at once.

**Mayday.**—Work has been resumed on the lower tunnel to tap this mine on Mokelumne Hill, of which Thos. Poynton is superintendent.

**Santa Rita.**—J. H. Mitchell has taken charge of this mine at Rich Gulch, and work will soon begin.

## ELDORADO COUNTY.

(From Our Special Correspondent.)

**Upton.**—This mine is reported sold to Pennsylvania men, and S. C. Wheeler has a contract to bring a 10-stamp mill from Quartz Mountain. This mine is 7 miles from Plymouth. The same company has bought the Wheeler mines near Plymouth.

## MALIPOSA COUNTY.

(From Our Special Correspondent.)

**Copertown Mining and Smelting Company.**—This company contemplates putting in a 30-ton water-jacketed furnace on its property at Hunter Valley. Oil may be used as fuel. C. H. Street, the president, has offices in Examiner Building, San Francisco, Cal.

**Gribaldi.**—Although this mine at Kinsley is much troubled with water, the big skips and pumps control it. The new stamp mill is nearly completed and cables are being put on the hoist.

## MONO COUNTY.

(From Our Special Correspondent.)

**Belle.**—W. C. Pidge and S. G. Lines are opening for a Philadelphia, Pa., company a large deposit of low-grade gold and silver ore near Benton. The Belle is one of the claims.

**Golden Gate.**—A 3-stamp mill has started at this mine, near Bridgeport.

## NEVADA COUNTY.

(From Our Special Correspondent.)

**Grass Valley Consolidated.**—The old Electric Mine will start as soon as all the water is out. Electric motors of 90 h. p. will furnish power. Machinery for an electric hoist is also being installed. Superintendent Coffin has arranged for hanging to steam power should this be required at any time.

**Meadow Lake.**—The new stamp mill, of which Captain Ord is manager, has started.

**Old Home Consolidated.**—Work is to start on this mine in Blue Tent District 22 miles from Nevada City, under Walter Logan. A 150-ft. tunnel is to be run.

## SHASTA COUNTY.

(From Our Special Correspondent.)

**Balaklala.**—At this mine, where W. W. Adams is in charge, 9 diamond drill holes have been put down, disclosing large bodies of ore, since the bond was taken by Mr. Peter Kimberly.

**Consolidated Copper Mining Company.**—Deeds have been recorded transferring to this company 10 claims in the Kosk Creek section.

**Mountain Copper Company.**—This company at Keswick will shortly have its converter stands in

position and when ready will ship to the refinery in New Jersey black copper instead of matte.

**Mount Shasta Gold Mines Corporation.**—This company, near Shasta, under management of F. E. Ware, is putting in boilers, hoist, engines, a 4-drill hand compressor, 2 Merrall mills and 4 Woodbury concentrators. The ores were formerly sold to the Mountain Copper Smelters, at Keswick, but the company will now work them.

## TUOLUMNE COUNTY.

(From Our Special Correspondent.)

**Belcher.**—This mine, near Stent, has been bonded by Mrs. G. W. Hall to J. M. McFarland.

**Darrow.**—The machinery on the Hampton Mine has been removed to this pocket mine near Tuttle-town, worked under bond by Joseph, Edward and Wm. Hampton.

**Eagle-Shawmut.**—The new hoist is completed and a 100-stamp mill is being constructed. The mine is working about 200 men and has both cyanide and chlorination works. The old 40-stamp mill is working steadily.

**Fidelity.**—The mill at this mine, near Columbia, is nearly completed. Thomas Conlin and A. S. Graham are the principal owners.

**Golden Gate & Sulphuret Mining Company.**—The chlorination plant of this company near Sonora, has been started up. About 40 men are at work in the mine. The entire plant has been overhauled.

## TRINITY COUNTY.

(From Our Special Correspondent.)

**Attoona Quicksilver Mining Company.**—A gold quartz ledge near Summerville is held under bond by this company, under the superintendence of Joseph Porter. Development shows encouraging features.

**Coffee Creek District.**—The Headlight, Strode and Lawrence mines at Coffee report a good season. J. C. Steele, of the Golden Jubilee Mine, states that the survey for the new road from Coffee Creek to the railroad at Delta is nearly done. There are 22 men working on the Golden Jubilee.

**Fortuna Copper Company.**—This company has bonded, through J. W. Turner, its 25 copper claims on Mad River, 30 miles east of Bridgeville. The consideration is \$3,000 for each claim.

**Trinity Gold Placer Mining Syndicate.**—This company, at Abrams, under the management of Wm. Maitland, is conducting large operations. The gravel in the old channel prospects rich. A new pipe line from Union Creek was put in last summer.

## COLORADO.

## CLEAR CREEK COUNTY.

(From Our Special Correspondent.)

**Output for 1901.**—An estimate for the year gives the output of Clear Creek County as follows: Gold, \$1,100,140; silver, \$1,315,480; lead, \$152,000; copper, \$57,180; zinc, \$3,200; total production, \$2,628,000; options and deals, \$2,765,000; miners employed, 2,045; development work, 16 miles; locations, lode claims, 1,122; mill sites, 80; tunnel sites, 45; patents, 192; new mills, 3; rebuilt, 1.

**Big Fice Association.**—Final payment amounting to \$20,000 has been made on the Doves Nest Mine, giving title to 7 claims of the Doves Nest Group. It is the intention to start a level from either the Gem or Arizona and drive west 1,300 ft. to reach Doves Nest ground. The company has also put in a new Leyner drill at the Central Tunnel and one at the Wilcox Tunnel.

**Newhouse Tunnel.**—An important strike is reported in this tunnel. The streak is almost solid and of fair width. Samuel Newhouse visited the tunnel recently. Some half dozen companies are drifting on ore bodies, but the present strike was made in company ground. L. Hanchett, the manager, has gone to Chicago to purchase another Norwalk compound compressor which will give the company 3. The tunnel is now over 13,000 ft. in. The Gem Company is shipping about 1,000 tons of ore per month from its vein.

## GILPIN COUNTY.

(From Our Special Correspondent.)

**Mining Deeds and Transfers.**—C. B. Eggleston to J. F. Raphael,  $\frac{1}{2}$  interest in Belle Flower Lode, Central District; L. H. Stockbridge to E. M. Baldwin, the Caledonia and Caledonia No. 2 lodes, Lake District; Fidelity Real Estate and Leasing Company to H. M. Cowell,  $\frac{1}{2}$  interest in British Lode, Illinois Central District; A. Widman et al to J. S. Brown,  $\frac{1}{4}$  interest in Harkinson, Juno, Plutus, Ceres, Ada Nos. 1 and 2 lodes, Mars, and the Washington, Lincoln, Garfield and Jefferson lodes, in Pine District; C. C. Dill to A. M. Dill,  $\frac{1}{2}$  interest in Blue Diamond Lode; C. S. Ripley, trustee to F. A. Snowman, the East Louisiana and Sweepstakes lodes in Pine District; J. F. Raphael to A. W. Gonhlin,  $\frac{1}{4}$  interest in Belle Flower Lode; W. A. Robinson to Ben Olson, 1-6 interest in West Perigo No. 3 Lode in Independent District; C. S. Ripley, trustee, to Boston-Occidental Mining Com-

pany, 1-100 interest in Mascot Group of 5 lodes in Pine District; V. Marek to M. W. Truxow, 1-32 interest in Lone Tree and Riverside lodes, in Russell District; H. E. Hazard to G. Kruse, 1-16 interest in Early Bird and Hill Top placers in Kansas District; G. W. Stockman to L. D. Hobson, the Matt France and Gauntlet lodes in Illinois Central District.

**California.**—Some good ore has been struck in the 2,200-ft. level and heavier shipments will follow. The property is worked by the Patch Mining Company with P. McCann as manager.

**Cashier Mines No. 1.**—Shipments of the first-class ores show values of \$175 per ton, while the second-class goes \$104 per ton. The grade is much above the average. B. L. Campbell, Central City, is in charge.

**Gauntlet Gold Mining Company.**—This company composed of Iowa men has taken up the option on the Gauntlet and Matt France lodes, paying for them \$10,000 to J. Franks, of Central City, Colo., and W. Blizzard, of Indianapolis, Ind. The company will sink and carry on heavier developments. P. N. Rugg, Central City, is manager.

**Gold Anchor.**—Illinois and Indiana parties have taken up the option, and a new plant of machinery is being installed. Some \$200 ore has been uncovered and steady operations will be carried on T. I. Slater, Yankee, is manager.

**Gowers Mines Syndicate, Limited.**—Instructions have been received to sink the shaft 250 ft. more, making it 850 ft. deep. The usual heavy shipments are being made and the company has declared big dividends this year. Dr. Gower, of Denver, Colo., is manager.

**Gregory-Buell Consolidated Gold Mining and Milling Company.**—A small plant of machinery has been placed on the Gregory second shaft. The water will be taken out, and some development carried on. The water in the Buell shaft is almost out and repairs in the shaft are about completed. A Cornish pump will be put in, and regular developments will soon start.

**Heavy Wind Storms.**—On December 17 and 18 high winds did considerable damage to mining property. About 24 smokestacks were blown down, the Carr tramway had 9 of its towers blown over and the Avon Company tramway was damaged. The total damage amounted to several thousand dollars.

**Woods.**—Lessees will pump out this uranium mine. The shaft is down 150 ft. and has produced some uranium ores running from 15 to 35 per cent. This was the first uranium mine located in Colorado, some time in the '70's, and but for litigation might have been a big producer. C. V. Hanks, Central City, is manager.

## LAKE COUNTY—LEADVILLE.

(From Our Special Correspondent.)

**Blonger.**—This Fryer Hill property has ceased shipments pending development work at the 300-ft. level.

**Coon Valley.**—An effort will be made to resume on this Rock Hill proposition. The lessees early in the year opened a fine lead body at 600 ft., but apparently cannot mine to advantage with a small shaft at such depth and a new shaft will have to be sunk to develop the mine properly.

**Coronado.**—This mine pumps 800 gals. of water per minute, the heaviest flow now in the Leadville basin. The pumping expense is shared by other basin properties. The mine is making small iron shipments from a fair grade body.

**Golden Eagle Mining Company.**—The only territory operated is that of the Vinnie Leasing Company, on the Vinnie ground, which is making a small tonnage daily of oxidized iron ore.

**Grover Clelland.**—The new lessees on this property and the Jay Bird claims are opening up a body of zinc ore which is being treated by the company's plant, the Leadville Concentrating Mill.

**Hap Hazard.**—New machinery is being put in prior to sinking a deep shaft on the vein. Early spring will see a milling proposition considered for handling the great quantities of low-grade honey-combed quartz carrying gold values.

**New Leadville Home Mining Company.**—The 14th dividend has been distributed the past week. In the new territory in Alice ground a continuous ore body is exposed over 50 ft., while the grade of iron continues to improve. The company is shipping 300 tons a day of good grade iron ore.

**Phoenix Mining Company.**—Shipments have increased from the Sixth Street shaft to 175 tons daily of oxidized and manganiferous iron. The latter goes to the steel works at Pueblo.

**Resurrection.**—New lessees have the incline shaft and are shipping from it 10 tons a day of good grade lead ore carrying gold and silver.

**Silver Wave.**—New lessees have secured a long time lease on this property and work is resumed.

**Triumph.**—There is talk of a resumption on this



mine which has been idle the past year. It is well located on the gold belt.

**Valentine Mining Company.**—Manager Dyatt of the Leadville Home Mining Company, at the request of stockholders of the Valentine, has submitted a proposition for an extension of the leases and to raise money to continue the work suspended from lack of funds some months ago. Another meeting will be held in January.

OURAY COUNTY.

(From Our Special Correspondent.)

**Altoona.**—This property has been compelled to close on account of water encountered in the north drift. In the spring adequate pumping machinery will be installed and development continued.

**Calliope.**—This property has been secured by Felix Jones under a one-year's lease and a car-load of very rich ore has been shipped to the Denver smelters. A contract will be let shortly for running a 500-ft. upraise.

**Camp Bird Extension Mining Company.**—This company at Ouray is pushing its tunnel as rapidly as one shift of 7 men can drive it. Supplies are in for the winter and all the ore mined is thrown into the dump, the company intending to erect a 60-ton stamp mill in the spring. The tunnel is 890 ft. and will go 600 ft. further, where it is expected to cut the famous Camp Bird vein. A new No. 10 Gardner electric drill is being tried and has so far proved entirely satisfactory. A new device, steel sheets for catching all the ore broken from the breast, has been adopted and proves far superior to the old method of catching the ore on canvas. Motive power for the mine is supplied from the Ames plant at Telluride.

**National Bell.**—This property, since its sale to a company of New York and London men, has been consolidated with the old Guston and will be worked to its full capacity. Pumps of large capacity are being put in and the properties will start up as soon as the workings are unwatered. George W. Crawford, former manager of the old Lout, has been engaged as manager.

**Ouray Electric Light and Power Company.**—This company is erecting a dam across Uncompahgre Canon near Ouray, and will install new and powerful electrical machinery to supply neighboring mines with power. The dam is 70 ft. high and will be completed in the early spring.

**San Juan Electric and Railway Company.**—This company has been organized to construct and operate an electric railway, as well as furnishing electrical power for mines. Richard Whinnerah, chief engineer, will begin preliminary surveys at once, and Manager Taff is going East January 1 to purchase the machinery. The power plant will be erected in Ouray and the electric railway will run from Ouray to the company's coal mines about 10 miles north of Ouray, and ultimately to North Fork, in Delta County, and Red Mountain on the south, connecting at that point with the Silverton Railway. The company agrees to contract for supplying light and power to consumers by May 1, 1902.

TELLER COUNTY—CRIPPLE CREEK.

(From Our Special Correspondent.)

**Ajax Gold Mining Company.**—The directors have issued a call for the annual meeting with a notice that a proposition to increase the capital stock is to be considered. The mine is on Battle Mountain, adjoining the Coriolanus and has been making good shipments for some time. No reason is given for this increase in the capital. The company is a close corporation.

**Consolidated Mines Company.**—The directors recently declared a Christmas dividend of 10c. a share, amounting to \$190,000, the largest monthly dividend on record for a Cripple Creek Company. The regular rate is 1c. a month, but the good strike in the Wild Horse, enabled the company to declare this Christmas dividend. F. M. Woods, manager of the company states that the ore is now open in the 765-ft. level for about 40 ft. and that the values are all that had been anticipated. The company has a very bright outlook, having much property as yet unexplored.

**Doctor-Jack Pot Consolidated Mining Company.**—The old Doctor shaft house over the incline shaft is totally destroyed by fire of unknown origin. The loss is estimated at \$10,000, covered by insurance. Work is now done through the Morning Glory Shaft.

**Nugget Mining Company.**—This company has announced that after December 31 stockholders of record on that day can obtain a dividend of 1 share of Doctor-Jack Pot for every 3 of Nugget. This distributes the latter company's 300,000 shares and winds up all its business. A special meeting is called to dissolve the corporation.

**Woods Investment Company.**—Litigation has just started between this company and A. P. Mackey, of Denver, for apex rights in the case of the Jerry Johnson Company versus the Damon Company. The suit involves a valuable ore body opened up about 20

months ago on the north slope of Ironclad Hill. The Woods Investment Company controls the Damon Company. Both sides are confident of winning the case, which will be watched with considerable interest.

IDAHO.

IDAHO COUNTY.

(From Our Special Correspondent.)

**Cracker Jack Mining and Milling Company.**—This company has filed articles of incorporation. The capital stock is 1,000,000 shares at 10c. each. The incorporators are Geo. K. Reed, R. W. Hawley, Claud Fline and W. W. Brown, of Grangeville, and W. A. Stevens, manager of the Buffalo Hump Syndicate at Callender. Men are at work on the Cracker Jack Mine, making preparations for a 5-stamp mill ordered from the Allis-Chalmers Company, of Chicago, Ill. A test run is reported to have showed values of \$100 per ton.

**Jumbo.**—Frank Brown has deposited in the Bank of Camas Prairie at Grangeville, 333 oz. bullion, the result of a 30 days' run of the 4-stamp mill. The value of the bullion is \$5,000. The value of concentrates saved is \$1,600. The north stope in the mine shows 11 ft. of ore, and the south stope, 9 ft., all of which is being mined.

MICHIGAN.

COPPER—HOUGHTON COUNTY.

**Arcadian.**—At the recent annual meeting in Jersey City, N. J., the company issued a financial statement which valued the real estate and mills at \$3,517,007, but gave no information of value. The following directors were re-elected: A. C. Burrage, Sidney Chase, C. D. Burrage, Nathan Leopold, H. G. Forman, H. H. Rogers, Wm. Rockefeller, C. M. King, and Wm. A. Paine. Willard Brown moved that the president or manager of the company furnish the stockholders with a report as to the condition of the property, quantity of ore mined, cost of mining it, the gross and net receipts of the company for the past fiscal year, etc. This motion was lost, and when it was seen that the proxies were held by interests opposed to furnishing any information, Mr. Brown immediately offered a resolution respectfully requesting this information. The purpose of the resolution, it is said, was to put Mr. Brown on record as having made a request in case he desired to bring mandamus proceedings compelling the company to furnish information.

**Copper Range Consolidated Company.**—This company has effected permanent organization by the election of William A. Paine as president and Frederick Stanwood as treasurer. Following is the list of directors: John Stanton, of New York City; Samuel L. Smith and Cameron Currie, of Detroit; J. Henry Brooks, Charles H. Paine, E. B. Maltby, Frederick Stanwood and William A. Paine, of Boston, and Kenneth McLaren, of New Jersey. It is stated that already over 90,000 shares each of Copper Range and Baltic stock have been deposited.

MISSOURI.

ST. FRANCOIS COUNTY.

(From Our Special Correspondent.)

The recent severe weather caught the mines short of coal, which with the inability of the transfer lines to move the coal cars, caused several plants to shut down. All diamond-drill prospecting was stopped and most of the drills have been housed for the winter.

**St. Joe Lead Company.**—The Gumbo or No. 10 shaft house of this company was destroyed by fire on December 22, but as the machinery was not seriously damaged hoisting will be resumed within 30 days.

MONTANA.

SILVER BOW COUNTY.

**Anaconda.**—Judge Clancy last week overruled the application of this company for the setting aside of the order allowing F. Augustus Heinze the privilege of inspecting and surveying the workings of the Anaconda and St. Lawrence mines. The action involves an alleged trespass upon the ore body of the Fairmount Mine. Attorney C. F. Kelly, for the Anaconda Company, asked for a stay in the carrying out of the order. Judge Clancy ruled that the order of survey and inspection should become of force and effect December 31. It is said that Heinze's men attempting to enter the St. Lawrence workings found the ladder way dismantled and the hoisting engines idle.

PENNSYLVANIA.

ANTHRACITE COAL.

**Philadelphia & Reading Coal and Iron Company.**—This company makes the following statement for November and the five months of the fiscal year from July 1 to November 30:

	November.	Five Months.
Earnings .....	\$3,034,545	\$12,821,381
Expenses .....	2,684,770	11,537,125
Net earnings.....	\$349,775	\$1,284,256

For the five months there was an increase of \$1,995,037 in earnings; an increase of \$1,287,067 in

expenses; and a resulting gain of \$707,970 in the net earnings.

SOUTH DAKOTA.

CUSTER COUNTY.

(From Our Special Correspondent.)

**Clara Belle.**—Regular clean-ups are being made in the 2-stamp Tremaine mill. A new mill is to be built in the spring.

**Crown Mica.**—A new vein of mica has been encountered at the 90-ft. level. The property is owned by the Chicago Mica Company, of which F. C. N. Graydon is general manager.

**May Mining Company.**—The property in Lightning Gulch is being developed with a shaft. Good free milling ore is encountered. The company is composed of Custer business men.

**North Star.**—A 20-stamp mill is to be delivered some time in April. It will have concentrating tables and a cyanide annex. The shaft is 340 ft. deep.

**Old Bill.**—J. B. Safford has a bond on the ground and is putting up a hoist and pumping machinery, which are being moved over from the Golden Slipper.

UTAH.

(From Our Special Correspondent.)

BEAVER COUNTY.

**Horn Silver.**—This mine forwarded to the Salt Lake Valley smelters 326,800 lbs. of first-class ore for the week ending December 21.

**Majestic.**—This company has opened rich ore on the 400 level on the O. K. A shipment of 10 cars of first-class copper ore is now on the way to the Salt Lake Valley smelters.

**Milford Gold and Copper Company.**—This company has filed articles of incorporation in Salt Lake City with a capitalization of \$300,000 in \$1 shares. The officers are: L. L. Downing, president; R. L. Wolf, vice-president; Clyde Opelt, secretary, and S. G. Dye, treasurer. The company owns the Big Fraction, Idaho, and Mark Hanna claims in Star District.

JUAB COUNTY.

(From Our Special Correspondent.)

**Tintic Shipments.**—The following are the shipments for the week ending December 21: Silver Summit, ore, 46,270 lbs.; Yankee Consolidated, 13 cars, ore; May Day, 3 cars; Gemini, 15 cars; Carisa, 2 cars; Grand Central, 5 cars; Mammoth, 13 cars; Lower Mammoth, 2 cars; Tesora, 4 cars; Swansea, 5 cars.

**Boston & Tintic.**—The manager, Wm. H. Tibbals, reports that ore has been encountered on the 170-ft. level of this property near Silver City. Assays are reported to show 14 per cent lead, 92 oz. silver and \$2 in gold. The streak averages 5 in.

**Salvator and Nevada.**—These claims on Godwa Mountain, Tintic, are to be worked by David Evans, who, it is understood, has arranged to open up his territory through the La Reine workings.

**Tetra.**—This Tintic mine has opened a showing of silver-lead ore in a drift run towards Godina ground.

SALT LAKE COUNTY.

(From Our Special Correspondent.)

**Bingham Shipments.**—The following are the shipments from Bingham for the week ending December 21: Acme, ore, 170,300 lbs.; Commercial, ore, 50,650 lbs.; Tiawauke, ore, 57,870 lbs.; Ben Butler, ore, 331,300 lbs.; Phoenix, ore, 39,500 lbs.; New England ore, 39,860 lbs.; Butterfield Company's Queen Mill concentrates, 105,650 lbs.; Ben Butler, 272,500 lbs., concentrates.

**Bingham Consolidated Mining and Smelting Company.**—A strike of considerable importance is reported at a depth of 150 ft. on the Miners' Dream Claim at Bingham. The ore is red and black oxide of copper and samples from about 4 ft. of the vein assay well in copper with some gold and silver. The Company forwarded 300 tons of matte to the Butte & Boston Smelter in Montana for the week ending December 21.

**Flagstaff.**—This property at Alta, belonging to an English Company, which has been idle many years, is likely to be operated again the coming year. Frederick Hawdon, of the London firm of Hawdon & MacLachlan, president of the company, is in Salt Lake to close a deal with some Utah people on a large block of stock. There are thousands of tons of milling ore on the dumps, only the high-grade ore having been shipped to the smelters.

**Grizzly & Lavina.**—This property at Alta forwarded 48,200 lbs. of first-class ore for the week ending December 21.

**Salt Lake Bullion Settlements.**—The settlements at Salt Lake for the week ending December 21 are: Bullion, \$15,100; cyanides, \$3,200; gold bars, \$14,600.

**Unite. States Company.**—Construction on the company's smelter is going on rapidly. The plant is to have a capacity of 1,000 tons of ore per day.

SUMMIT COUNTY.

(From Our Special Correspondent.)

**D. & M.**—This mine in Thaynes Canyon has opened up a nice body of carbonate ore. The mine adjoins the Comstock on the north and Manager James Duffy thinks that he will be shipping soon.

**Park City Shipments.**—The following are the shipments from Park City for the week ending December 21: Anchor, ore, 483,470 lbs.; Ontario, ore, 1,552,820 lbs.; Quincy, ore, 826,300 lbs.; Daly-West, ore, 429,750 lbs.; concentrates, 334,410 lbs.; Silver King, ore and concentrates, 1,458,600 lbs.

**Superior.**—A drift is now being run from the bottom of the shaft in the cross-fissure to the main ledge.

**Wabash.**—Superintendent Richard Campbell reports the shaft down 190 ft.; the buildings are completed and the machinery is all installed.

TOOELE COUNTY.

(From Our Special Correspondent.)

**Stockton Shipments.**—The following are the shipments for the week ending December 21 to the Salt Lake Valley smelters: Hidden Treasure, ore, 91,066 lbs.; Ophir, concentrates, 306,880 lbs.; Utah Queen, ore, 45,570 lbs.

**Consolidated Mercur.**—A large tonnage is coming from the new ground in the Lulu Claim. The mill is sending forward the usual amount of cyanides. A total of 282,000 tons of ore was treated by the mill in 1901.

**Geyser Marion.**—The Rover and other claims are being experted with the view of a consolidation being made. Work will soon begin on the ore bodies known to exist in this large area.

FOREIGN MINING NEWS.

CANADA.

BRITISH COLUMBIA—BOUNDARY DISTRICT.

**Boundary Shipments.**—The Granby group, at Phoenix, is now sending out regularly over 700 tons daily, and the Mother Lode Mine is shipping more ore per week than formerly. Figures for the week ending December 14 and for the year are as follows:

	Week.	1901.
Old Ironsides, Knob Hill and Victoria.....	5,091	218,761
B. C. Mine.....	780	42,595
Winnipeg.....	25	980
Athelstan.....	550	550
Snowshoe.....	1,593	1,593
R. Bell.....	560	560
Mother Lode, Deadwood.....	3,104	83,935
Sunset, Deadwood.....	395	395
No. 7 Central.....	940	940
King Solomon, Copper.....	1,250	450
Jewel, Long Lake.....	450	1,300
Other Boundary mines.....	1,300	1,300
Totals, tons.....	9,060	353,399

BRITISH COLUMBIA—ROSSLAND DISTRICT.

**Rossland Shipments.**—The output for the week ending December 14 and for the year to date, according to the Rossland Miner, is as follows:

	Week.	Year.
Le Roi.....	4,200	153,888
Le Roi No. 2.....	1,250	36,460
Centre Star.....	.....	54,648
War Eagle.....	.....	20,100
Rossland Great Western.....	300	10,381
Iron Mask.....	.....	3,733
Homestake.....	.....	20
I. X. L.....	.....	230
Spitzee.....	.....	200
Velvet.....	.....	563
Monte Cristo.....	.....	20
Evening Star.....	.....	74
Giant.....	.....	52
Portland.....	.....	24
Totals.....	5,750	280,493

**Centre Star.**—About 100 men are now employed. Shipments are not likely to begin until about the middle of January, because of the changes being made to the Trail Smelter.

**Le Roi.**—Work has started on the development mapped out for the winter. The loading chute at the 1,050-ft. station in the main shaft is well under way. The shaft will be sunk and drifts started east and west of the shaft.

**Le Roi No. 2.**—The regular mining operations are going ahead steadily. Good progress is made.

**Nickel Plate.**—The operations on the Rossland Great Western's property are going on steadily. Reports are that the mine is steadily improving, and that increased shipments may be looked for.

BRITISH COLUMBIA—TEXADA ISLAND.

**Texada Gold Mines Company.**—The stockholders at the recent annual meeting in Seattle elected the following officers: S. M. Lockerby, of Valley City, N. D., president; L. W. Gray, of Seattle, vice-president; M. Galbraith, of Texada, B. C., treasurer, and W. S. Planta, of Texada, secretary. The same gentlemen, along with Dr. A. E. Oviatt, of Valley City, N. D., were elected trustees.

BRITISH COLUMBIA—SLOCAN DISTRICT.

**Slocan Shipments.**—The total amount of ore shipped from the Slocan and Slocan City mining divisions for the year 1900 was, approximately, 35,000 tons. Since January 1 to December 14, the shipments, according to the New Denver Ledger, have been as follows:

	Week.	Total.
Payne.....	.....	1,888
Last Chance.....	40	1,339
Slocan Star.....	260	3,896
Ruth.....	.....	279
Bosun.....	20	500
Hewett.....	.....	1,894
American Boy.....	23	1,400
Ivanhoe.....	40	1,237
Sunset (Jackson Basin).....	.....	703
Sovereign.....	117	117
Wonderful.....	.....	106
Arlington.....	60	5,027
Two Friends.....	.....	40
Enterprise.....	20	640
Hartney.....	.....	140
Black Prince.....	.....	155
Goodenough.....	22	237
Miller Creek.....	.....	20
Reco.....	66	345
Sunset (Can. Gold Fields).....	.....	53
Silver King.....	.....	14
Noble Five.....	.....	59
Washington.....	.....	30
Red Fox.....	.....	123
Antoine.....	.....	16
Queen Bess.....	.....	1,109
Monitor.....	.....	480
Corinth.....	.....	81
Bondholder.....	.....	26
Rambler (November).....	450	2,950
Surprise.....	.....	200
Kaslo Group.....	.....	10
Chapleau.....	.....	15
Speculator.....	.....	10
Ajax.....	.....	10
Soho.....	.....	70
Emily Edith.....	.....	40
Phoenix.....	.....	23
Alpha.....	.....	40
V. & M.....	.....	20
Marion.....	.....	22
Ruby.....	.....	1
Esmeralda.....	.....	6
Hampton.....	.....	2
Capella.....	.....	44
Fourth of July.....	.....	12
Tamarac.....	.....	5
Mary Durham.....	.....	8
Buffalo.....	.....	5
Sweet Grass.....	.....	2
Totals, tons.....	1,003	25,539

BRITISH COLUMBIA—VANCOUVER ISLAND.

**Thistle.**—John M. Wright, president of the Alberni Copper and Gold Company, Limited, owner of this mine, at Alberni, recently said that work on the mine had been suspended until good weather begins in the spring, as the company could not complete the road to the mines without too great expenses during the prevalence of rain storms.

ONTARIO—LAKE OF THE WOODS DISTRICT.

(From Our Special Correspondent.)

**Anglo-Canadian Gold Estates.**—This concern is opening up some rich deposits on Sturgeon Lake, and has located what promises to be some rich placer ground.

**Bully Boy.**—This mine, near Rat Portage, has been bonded to an English syndicate, with stipulations which require the continuous development of the property. The development already accomplished has been an important factor in promoting the deal.

**Elizabeth.**—This mine, on Seine River, has its main shaft down 220 ft. The total amount of underground work is about 600 ft. The water in the workings is under control by the pump received from the Northey Manufacturing Company, Toronto. There is a complete air compressor plant. The erection of a stamp mill will be deferred until a large amount of ore is in sight.

EUROPE.

GREECE.

In the half-year ending June 30, 1901, the mines at Laurium produced 8,929 metric tons of silver-bearing lead ores, all being exported; 4,041 tons went to Belgium, 3,340 tons to France, and 1,548 tons to Germany.

The output of zinc ores included 104 tons of blende, all sent to Germany; and 5,715 tons of calamine, of which 3,555 tons went to Belgium and 2,160 tons to Germany.

The hematite iron ores mined were 79,820 tons, of which 65,880 tons went to Great Britain, 13,428 tons to Austria and 512 tons to the United States. Manganiferous ores mined were 128,653 tons; exports were 63,730 tons to Great Britain, 32,285 tons to Germany, 15,400 tons to Italy, 11,538 tons to Belgium, and 5,700 tons to France.

The total output of emery was 92,541 quintals of

56 kilograms each, the average value at the mines being 6 drachms per quintal. The exports included 59,409 quintals to Germany, 27,743 quintals to Great Britain, and 5,389 quintals to the United States.

MEXICO.

DURANGO.

(From Our Special Correspondent.)

**Arino Mines.**—This company is making numerous alterations in its mills. Experiments during the past year with a small lixiviation plant have convinced the company that it can thus save a greater per cent of its values and it will therefore reduce its concentrating plant considerably. The mill when arranged will handle about 400 tons daily by the new process. The stock is mostly held in London.

**Mapami District.**—During last month 327 mining pertinencies were denounced this district and 2 mines have been solicited for exploitation. The first embraces 6 kilometers on the west side of the Sierra de la Buja and the second a section of 1,600 square meters on the mountains of Sombrerete. The American syndicate exploiting the Penoles and Descubridora mines, is making extensive repairs and improvements. The smelters have been enlarged, new machinery erected as well as new buildings for dynamos to operate the machinery and the railroad by electric power.

**Restauradora Mines.**—The plant at Guanacevi is to be largely increased and correspondence is going on with American machinery firms. The output in November was 33 bars of silver.

MICHOACAN.

(From Our Special Correspondent.)

**General Electric Company.**—This New York City company has a number of mining engineers in the copper districts of this state.

NUEVO LEON.

(From Our Special Correspondent.)

**Buena Vista.**—These mines are located in the Santa Caterina District near the National Railway. Work was interrupted for some weeks owing to a cave-in, but shipping has been resumed and it is claimed that cars are running as high as \$2,000 each, net, Mexican. Development is pushed and a large body of ore has been opened.

**Carrazal District.**—Many mines are beginning to ship and much new development work is underway. The Maiz Brothers' properties in the Cerro Boluda, the Violeta and India, are turning out large shipments. The main breast of the Violeta shows a good width of 17 per cent copper ore, carrying a little gold and silver. Other breasts are showing good copper ore running from 6 to 10 per cent. The old Los Angeles Mine is shipping regularly a fine grade of copper running from 10 to 20 per cent. A large concentrating plant is to be erected at Bustamente.

OAXACA.

(From Our Special Correspondent.)

**Compania Minera Mexicana.**—This company has a working bond on the Renacimiento y Anexas mines and is erecting a steam hoist. The vertical shaft is now 140 ft. deep, at which depth the vein was cut and found to be 35 ft. wide. This mine adjoins the Conajo Colorado Company's mines on the south and has the same vein. The croppings show boldly for over 2 miles, and measuring from 10 to 30 ft. wide.

**Los Reyes.**—These mines at Perez, 30 miles from Oaxaca have just ordered 10 additional stamps and the company is in the market for a large amount of general machinery.

**Natividad Mining Company.**—This company has a Krupp ball mill on the way from Germany. Added to the present mill it will give a total capacity of 50 tons of ore per 24 hours. The company has paid over \$500,000 in profits during the past 5 years, mostly from high-grade shipping ores, some of which assayed 1,000 to 1,200 oz. silver and 30 to 40 oz. gold per ton.

**Sau Carlos.**—This mine has a shaft 180 ft. deep, from which cross-cuts to the vein have been run at 100 ft. and 70 ft., respectively; ore assaying high in silver has been extracted from each level. A steam pump is in use and a hoist has been ordered. The high grade ores are sold to ore buyers and the low grades shipped to the Conejos Colorado Mill.

**Sau Martin Mines.**—Two Merrel stamp mills are being erected on this property, 12 miles south of Oetlan. There is a shaft of 163 ft. from which two levels have been run and a body of ore opened up said to average over \$60 per ton. The shaft is equipped with a steam hoist and sinking pump, and may be sunk to 400 ft. The mill is expected to be running early in January.

**Zimapan Mining Company.**—This company recently purchased the mines now worked at Zimapan. W. R. George, of New York City, is general manager and arrangements are completed for erecting a modern smelter. The company is placing orders in the United States. The cost is to be about \$300,000.





## CHEMICALS, MINERALS, RARE EARTHS, ETC. CURRENT WHOLESALE PRICES.

Abrasive			Barium			Graphite			Paints and Colors		
	Cust. Meas.	Price.		Cust. Meas.	Price		Cust. Meas.	Price		Cust. Meas.	Price
Carborundum, f.o.b. Niagara Falls, Powd., F. FF. FFF.	lb.	\$0.08	Oxide, Am. hyd. cryst.	lb.	\$0.02½	dence, R. I. lump.	sh. ton	8.00	Metallic, brown	sh. ton	\$19.00
Grains	"	.10	Sulphate (Blanc Fixe)	"	.02	Pulverized	"	30.00	Red	"	16.00
Corundum, N. C.	"	.07@.10	<b>Barytes</b>			German, som. pulv.	lb.	.01¼@.01½	Ocher, Am. common	"	9.25@10.00
Chester, Mass.	"	.04¼@.05	Am. Crude, No. 1.	sh. ton	9.00	Best pulverized	"	.01¼@.02	Best	"	21.25@25.00
Barry's Bay, Ont.	"	.07¼@.09¼	Crude, No. 2.	"	8.00	Ceylon, common pulv.	"	.02¼@.03¼	Dutch, washed	lb.	.04¼
Crushed Steel, f.o.b. Pittsburgh	"	.05¼	Crude, No. 3.	"	7.75	Best pulverized	"	.04@.08	French, washed	"	.01¼@.02
Emery, Turkish flour, in kegs.	"	.03¼	German, gray	"	14.50	Italian, pulv.	"	.01¼	Orange mineral, Am.	"	.08@.08¼
Grains, in kegs.	"	.05@.05½	Snow white	"	17.00	<b>Gypsum</b> —Ground.	sh. ton	8.00@8.50	Foreign, as to make	"	.08¼@.11¼
Naxos flour, in kegs.	"	.03¼	<b>Bauxite</b> —Ga. or Ala. mines:			Fertilizer	"	7.00	Paris green, pure, bulk.	"	.12¼
Grains, in kegs.	"	.05@.05½	First grade	lg. ton	5.50	Rock	lg. ton	4.00	Red lead, American	"	.05¼
Chester flour, in kegs.	"	.03¼	Second grade	"	4.75	English and French	"	14.00@16.00	Foreign	"	.07¼@.08¼
Grains, in kegs.	"	.05@.05½	<b>Bismuth</b> —Subnitrate.	lb.	1.40	<b>Infusorial Earth</b> —Ground.	"	"	Turpentine, spirits	gal.	.37¼
Peekskill, f.o.b. Easton, Pa.	"	.01¼	Subcarbonate	"	1.65	American, best.	"	20.00	White lead, Am., dry	lb.	.04¼@.04¾
flour, in kegs.	"	.02¼	<b>Bitumen</b> —"B"	"	.03¼	French	"	37.50	American, in oil	"	.05¼
Grains, in kegs.	"	.02¼	"A"	"	.05	German	"	40.00	Foreign, in oil	"	.07¼@.09¼
Crude, ex-ship N. Y.: Abbott (Turkey)	lg. ton	28.50@30.00	<b>Bone Ash</b>	"	.02¼@.02½	<b>Iodine</b> —Crude	100 lbs.	2.45	Zinc, white, Am., ec dry	"	.06¼
Kuluk (Turkey)	"	22.00@24.00	<b>Borax</b>	"	.07¼@.07½	<b>Iron</b> —Muriate	lb.	.05	American, red seal.	"	.06¼
Naxos (Greek) h. gr.	"	26.00	<b>Bromine</b>	"	.40	Nitrate, com'l.	"	.01¼	Green seal	"	.07
Garnet, as per quality	sh. ton	25.00@35.00	<b>Cadmium</b> —Metallic	"	1.40	True	"	.04	Foreign, red seal, dry	"	.05¼@.08
Pumice Stone, Am. powd.	lb.	.01¼@.02	Sulphate	100 lbs.	2.00@2.50	Oxide, pure copperas col.	"	.05@.10	Green seal, dry	"	.06¼@.09
Italian, powdered	"	.01¼	<b>Calcium</b> —Acetate, gray	"	1.25	Purple-brown	"	.02			
Lump, per quality	"	.04@.40	" brown	"	.85	Venetian red	"	.01@.01¼			
Rottenstone, ground.	"	.02¼@.04¼	Carbide, ton lots f.o.b. Niagara Falls, N. Y., or Jersey City	sh. ton	75.00	Scale	"	.01@.03	<b>Potash</b>		
Lump, per quality	"	.06@.20	N. J.	sh. ton	75.00	<b>Kaolin</b> —(See Clay, China.)	"	"	Caustic, ordinary	"	.04¼@.06
Rouge, per quality	"	.10@.30	Carbonate, ppt.	lb.	.05	<b>Kryolith</b> —(See Cryolite.)	"	"	Elect. (90%)	"	.06¼
Steel Emery, f.o.b. Pittsburgh	"	.07	Chloride, com'l.	100 lbs.	.75@.80	Brown	"	.07¼@.08			
			Best	"	1.00	Nitrate, com'l.	"	.06¼	<b>Potassium</b>		
						" gran.	"	.08¼	Bicarbonate, Am.	"	.09¼
									Powdered or gran.	"	.14
									Bichromate, Am.	"	.08¼
									Scotch	"	.08¼@.09
									Carbonate, hydrated	"	.04@.04¼
									Calcined	"	.03¼@.03¾
									Chromate	"	.35
									Cyanide (98@99%)	"	24@.25
									Manure salt, 20%	100 lbs.	.66
									Double Manure salt, 48@53%	"	1.12
									Muriate, 80@85%	"	1.83
									95%	"	1.86
									Permanganate, pure cr.	lb.	.12¼@.12¾
									Prussiate, yellow	"	.13¼
									Red	"	.37@.37¼
									Sulphate, 90%	100 lbs.	2.11
									96%	"	2.14
									Sylvinit	unit	.36¼
									<b>Quartz</b> —(See Silica)		
									Salt—N. Y. com. fine	sh. ton	2.00
									N. Y. agricultural	"	1.50
									<b>Saltpetre</b> —Crude	100 lbs.	3.50@3.55
									Refined	"	4.37¼@5.37½
									<b>Silica</b> —Best foreign	lg. ton	10.00@11.00
									Ground quartz, ord.	sh. ton	6.00@8.00
									Best	"	12.00@13.00
									Lump quartz	"	2.50@4.00
									Glass sand	"	2.75
									<b>Silver</b> —Chloride	oz.	.65
									Nitrate	"	3½
									Oxide	"	85@1.10
									<b>Sodium</b>		
									Bichromate	lb.	.08¼
									Chlorate, com'l.	"	.08¼@.08¾
									Hyposulphite, Am.	100 lbs.	1.60@1.65
									German	"	1.70@1.90
									Peroxide	lb.	.45
									Phosphate	"	.02¼
									Prussiate	"	.10¼
									Silicate, conc.	"	.05
									Com'l.	"	.01
									Sulphate, com'l.	100 lb.	.77¼
									Sulphide	lb.	.01¼
									Sulphite crystals	"	.02¼
									<b>Sulphur</b> —Roll	100 lbs.	1.85
									Flowers, sublimed	"	1.90
									Oil barrels	"	3.80
									<b>Talc</b> —N. C., 1st grade	sh. ton	13.75
									N. Y., Fibrous, best	"	10.20
									French, best	100 lbs.	1.25
									Italian, best	"	1.62¼
									<b>Tar</b> —Regular	bbbl.	1.90
									Oil barrels	"	3.80
									<b>Tin</b> —Crystals	lb.	20@21¼
									Oxide	"	.42
									<b>Uranium</b> —Oxide	"	2.25@3.00
									<b>Zinc</b> —Metallic, ch. pure	"	.07@.09¼
									Carbonate	"	.15
									Chloride	"	.05
									Dust	"	.05¼@.07¼
									Sulphate	"	.02¼@.02¾

## THE RARE EARTHS.

	Cust. Meas.	Price
<b>Boron</b> —Nitrate	lb.	\$1.50
<b>Calcium</b> —Tungstate (Scheelite)	"	.85
<b>Cerium</b> —Nitrate	"	11.00
<b>Didymium</b> —Nitrate	"	35.00
<b>Erbium</b> —Nitrate	"	40.00
<b>Glucium</b> —Nitrate	"	20.00
<b>Lanthanum</b> —Nitrate	"	30.00
<b>Lithium</b> —Nitrate	oz.	.60
<b>Strontium</b> —Nitrate	lb.	06¼@.07
<b>Thorium</b> —Nitrate 49@50%	"	5.00
<b>Uranium</b> —Nitrate	oz.	.25
<b>Yttrium</b> —Nitrate	lb.	40.00
<b>Zirconium</b> Nitrate	"	8.00

NOTE.—These quotations are for wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. Readers of the ENGINEERING AND MINING JOURNAL are requested to report any corrections needed, or to suggest additions which they may consider advisable. See also Market Reviews.