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FOREWORD.

In assuming the editorship of the Engineering and Mining Journal I realize the responsibility, not without honor, of the position. It will be my endeavor to maintain the paper in the forefront of technical journalism by doing as my friend, Richard P. Rothwell, did—publishing reliable information concerning current mining and metallurgical practice, written by men who are alongside of facts and not mere retailers of what others accomplish. The complete divorce of the paper from the influence of financial companies and the independence of the reading matter from the advertisements will be maintained. While the Journal will always be, first, metro-

politan, and then, broadly national, it will be my effort to recognize the whole arena of mining activity, including also those more distant countries where American engineering talent and American machinery find successful application.

This cannot be done without the hearty co-operation of the profession—that unwearied host of workers which includes mining engineers, metallurgists, geologists and explorers—the men, who, take them for all in all, have first blazed the trail for civilization and then set it going on whirring wheels. I appeal to the professional spirit of these engineering men for aid in making this Journal the vehicle for the best that is thought and done in the wide field of mining and metallurgical practice, because there is no waste so pitiful as the waste of experience, no blunder so lamentable as that which has been made twice and no success so splendid as that which, when told, incites others to fruitful result.

A paper like this can do little without the friendly assistance which looks for no specific return. One of the best ways of getting technical information is to begin by giving of your own to others. If you contribute your bit of advice, description or knowledge, others will be likely, in cheerful return, to give to you out of their stores of ascertained fact. Our leading technical men, it is fair to say, are most generous in the transmission of the experience and information collected by them in the course of a lifetime. The index to the volumes of this Journal testifies to this fact. The time has gone by for secret processes and secret methods, skill carries its own patent, co-operation will achieve more than isolation and interchange of ideas is more stimulating than selfish reticence. Our list of Special Contributors indicates that a number of recognized specialists, of high personal character, have agreed to give a helping hand; there are others, hardly less distinguished in their calling, who have given promise of aid; so that a good start appears assured. But this is not enough. I appeal to you, Sir, in your mine or mill, in your office or smelter, to make some return for all the assistance which others have given to you. You have benefited by the experience which has been laboriously and painfully accumulated by a long line of investigators and observers; this has been a guide to you above ground and a light to you underground. Make some return. Help others as you also have been helped, and realize something of the professional spirit which rejoices in giving rather than in abstracting technical information. To this work I invite you, with this purpose I appeal to you, and whether it be to my friends and comrades among the dry places of Australia, the awakened veldt of South Africa, the historic regions of Europe or the spacious sunshine of our Colorado mountains, to one and all on this the first day of this most auspicious year, I give the old Saxon miner's greeting—Glück Auf!

T. A. RICKARD.

New York, January 1, 1903.

The movement for a betterment of engineering and mining education in London which the Institution of Mining and Metallurgy has inaugurated is likely to have far-reaching effects. Several plans are on foot which, if carried out, will make South Kensington an up-to-date Charlottenburg. It is impossible to speak too highly of the public spirit evinced by the Institution, which by this practical interest in mining education has merited the esteem and good will of all professional men.



THE HISTORY of copper production and of the copper trade during 1902, which is briefly told elsewhere, forms an interesting study in economics. After a struggle, which had lasted for nearly two years, the trade has broken away from those who sought to control it. In spite of almost unlimited command and capital, efforts to concentrate the business have failed at least for the time, and the laws of supply and demand have vindicated their authority. No doubt the struggle will be kept up during the coming year, but we cannot foresee any different final outcome for it.



NATIONAL DEVELOPMENT.

Our columns to-day tell, with the dry eloquence of statistics, how the mining and metallurgical industries have grown during the past year. The comparison with earlier years proves that a decade is more than sufficient to double the wealth and resources of the country. Thus, the clearing house transactions increased from \$54,000,000 in 1897 to \$114,000,000 in 1901; individual deposits in the banks grew from \$4,665,000,000 to \$9,082,000,000 between 1892 and 1902; the imports of manufactured materials amounted to \$246,097,419 in 1892, and to \$365,862,839 in 1902, while the exports of manufactured articles increased during the same period from \$125,144,368 to \$347,240,920; the total of dividend-paying railroad stocks grew from \$1,485,618,453 in 1895 to \$2,977,575,179 in 1901, while the actual aggregate total of dividends during the same years increased from \$85,287,543 to \$156,753,784; the aggregate motive horse-power employed in manufacturing increased from 5,954,655 horse-power in 1890 to 11,300,081 horse-power in 1900; finally, between 1892 and 1902 the production of gold increased from 1,596,375 ounces troy to 4,243,357 ounces; that of copper, from 352,971,744 to 669,855,006 pounds; that of pig iron, from 9,157,000 to 17,740,574 long tons, and that of coal, from 179,334,071 to 293,271,667 tons.

The mere fact that these figures are intelligible bespeaks the change in our units of measurement. Not very long ago a million dollars was a fabulous sum, now it is a unit in the measurement of a billion, the latter have become an actuality in ordinary business by reason of the unprecedented expansion of industry.

This stupendous development has been built upon the resources of a virgin continent rich in all the materials needed by the modern world and exploited by means of scientific methods which have created an industrial mechanism of great complexity and astonishing efficiency. It has been done by the active hand and brain of a nationality full of the energy of a great youthfulness. We rejoice in that exuberance of re-

source and congratulate our fellow citizens on the magnificence of the results.



THE IRON TRADE.

THE IRON TRADE of the United States has always been considered a sort of barometer, the fluctuations of which represent the condition of national prosperity. If we accept this as true, and there is a great deal of truth in it, our prosperity was certainly at the highest point during the year just closed. Our total production of pig iron was over 17,700,000 tons, or equal to the output of our two chief competitors—Germany and Great Britain—taken together while the production of steel and of iron and steel in finished forms, far exceeded that of any previous year in any other country. The production of this pig iron involves the mining and handling of nearly 35,000,000 tons of iron ore, and more than twice that quantity of coal was absorbed in the trade. The amount of work required merely to handle these enormous amounts of material was naturally very great, and the labor employed in putting the iron through the various processes required to place it in marketable form, furnishes another item of large importance.

In turning out this great amount of material there was no accumulation of stocks and no working for the future. In fact, material was consumed as it was made, and even with great expansion, the mills were unable to fill promptly all orders received and a number of them closed the year considerably behind on their contract deliveries. No such year has ever been known in the iron trade of this country before. Moreover, our mills and furnaces are assured abundant work for the first half of 1903, while many of them open the year with contracts running well over toward the end. We may fairly assume that at least one more year of great prosperity is coming to all interests connected with the trade.

ONE FEATURE of the past year, to which we have heretofore referred, seems to us to carry with it a menace for the future. That is the extent to which the iron ore resources of the country are being gradually and quietly absorbed by a single interest. This is to some extent commented on elsewhere in this issue. It is a matter to which attention cannot be called too often; for it is a matter of grave public concern.



A SOBER THOUGHT.

The accumulation of statistics, which marks the beginning of every calendar year, brings home to the thinking man the enormous range of industrial activity, and the great production resulting from it; but amid the natural exultation arising from the contemplation of these results there should come also a sober second thought that size is not grandeur and wealth of commodities alone does not make a nation. What do these avail if the application of the forces of capital through the instrumentality of labor is to develop into an intelligent tyranny on the one hand or an unintelligent terrorism on the other?

Such considerations are brought home by the events of the past year. Doctrinaires may write and divines may preach on the "rights" of labor

and capital, but the logic of events sweeps both aside. We deal too much in shibboleths that have no meaning; Rousseau's "natural rights" were fallacies which political economy punctured and Huxley pulverized, and yet these restless wraiths of philosophy still roam like ghosts that are about when all well-ordered people lie safe in bed. So it is with the modern "rights" of capital and "rights" of labor which each man defines to his liking, and makes his excuse for selfish ends. It is the spirit, not the letter, of the law that abides. The purpose of our laws is to give all men an equality of opportunity, and at the same time to regulate the actions of the individual for the general good of the community, but, the fact is, our industrial development has outstripped the regulations of our society just as the twenty-five storied structures of a great city overshadow the narrow streets which were once, relatively considered, broad avenues.

Old laws and regulations no longer suffice to meet existing conditions, industry outspeeds legislation, and legislation is held back for fear it should make confusion by getting between the spokes of the industrial wheels. Until the inevitable readjustment takes place between the conventions of industrial life and the new methods of administration by masses, whether we call them corporations or unions, there remains for us the duty to cherish the spirit of our laws, a spirit dear to all true citizenship, and summarized in the words, fair dealing. To capitalist and workman alike it is the one thing needful, and the public, too, who plays Mercutio to their warring interests, must not go unprovided therewith. Right dealing ennobles mankind, and unless fair-play, in the broad, ethical sense, be not a strong element in our industrial life it will not avail much to the happiness of the community, no matter how fast we pile up the product of mine and factory.



A PLEASANT INCIDENT.

In looking backward over the events of 1902 there is one incident which it is particularly pleasant to underline, because it gives good augury for the future. We refer to the action which was taken by the Institution of Mining and Metallurgy in regard to the Royal School of Mines. Both organizations are English, both belong to London, yet in the impulse which inspired the interest of one in the other there was a professional feeling which went far beyond the limitations of locality, appealing rather to that generous spirit of the scientific world, which knows no geographical boundaries.

The Institution referred to, like its elder brother, the American Institute of Mining Engineers, is an association of professional men engaged in mining and metallurgical pursuits; both have a membership which extends the wide world over, more especially throughout English-speaking countries; both exist for the particular purpose of disseminating the technical knowledge of the day through the medium of papers written by men who are actual workers rather than academic thinkers; both have succeeded in contributing, by means of annual volumes of Transactions, a great mass of valuable literature which has afforded a decided stimulus to technical advancement; it remains but to add that in both

societies American and English engineers find themselves equally at home.

In the early part of 1902 the leading members of the Institution were led to consider the desirability of suggesting certain additions and alterations in the course of training at the Royal School of Mines, in consequence of a protest made by one of the graduates and the discussion which ensued in the London press. It was found, as might be expected, that, while the authorities at the School of Mines were inclined to disregard irresponsible criticism, they welcomed the suggestions of men who were representative of the best interests of the mining industry at home and abroad. Consequently, in June, a letter was addressed by the council of the Institution to the council of the School. This communication expressed the desire of the former to aid the latter in "improving the training" and "increasing the efficiency of the Royal School of Mines." The report of a special committee, composed of leading members of the profession, was submitted, and the good-will underlying the whole action of the Institution was emphasized by the endowment of the school with two scholarships, each having a value of fifty pounds per annum.

The London School of Mines is as poor in endowment as it is rich in noble traditions; it receives, from the government, only \$90,000 per annum, although it is the chief technical training college for the mineral industry of an Empire, the production of which in the seven most important substances alone exceeds a billion dollars per annum, an empire which produces two-thirds of the gold of the world, one-third of the coal and one-quarter of the iron, an empire whose business activity, among the mining and metallurgical industries, involves a capital which is as stupendous in amount as it is far-reaching in effects. Of the \$90,000 referred to only a fraction is spent in preparing men for the mining and metallurgical professions, the greater part being employed in the training of science-teachers for the government schools. While this paltry endowment is in pitiful contrast to the immense commercial activities of Englishmen and their wide territorial possessions, it seems even meaner when contrasted with that which money cannot measure; we refer to the fact that the history of the Royal School of Mines during the past fifty years is interwoven with the names of men so splendid in their scientific achievement as Murchison, Huxley, Tyndall, Percy, Ramsay, Warrington Smythe, Playfair and Judd. It would appear therefore that the interest of the Institution of Mining and Metallurgy was fully warranted.

Several suggestions were made by the committee which had charge of the investigation. We hope to refer to them at another time, but for the present we will state that the most important dealt with the erection of an ore-testing plant as an annex to the metallurgical laboratory and the inauguration of a post-graduate course in practical work at mines, mills or shops so as to permit of the acquirement of practical knowledge. These suggestions are in line with the trend of development in the best of our American schools, but they have also a value of their own in coming from men who know, through the experience of life, what is most needed to make useful mining engineers and metallurgists.

The committee which had the enterprise and esprit de corps required to take such public-spirited action contained among its members several American engineers, Mr. Hennen Jennings being especially prominent in wealth of useful suggestion. The experience which, it may be said, gave momentum to the advice of the committee was undoubtedly American and based upon the results obtained at the heavily endowed technical colleges on this side of the Atlantic. To us the incident seems to have a graciousness which is delightful beyond words and a practical value to the well-being of the profession which makes it an event of first-rate importance.



DEVELOPMENTS IN CYANIDATION.

The active resumption of mining in the Transvaal and the reorganization of many of the Kalgoorlie mines has drawn attention to the metallurgical processes in use in these two widely separated districts. Cyanidation holds the field in both cases. In South Africa the fact is hardly appreciated that while the mechanical side of the treatment has undergone close attention and consequent improvement, details of metallurgical practice have suffered from a lack of investigation. The stamp-milling proper and the working of the machinery itself have been developed to a great degree of practical efficiency, but the nice chemical tests necessary to a successful wet process of considerable intricacy have not met with the same appreciation, for the obvious reason that the average mine-manager is too busy to keep in touch with them. Quite lately Mr. Alfred James made a well-considered statement that the loss resulting to mining on the Rand by carelessness in the actual clean-up from cyanidation amounts to a minimum of 1 per cent and a maximum of 6 per cent of the entire output. The use of badly-cut zinc shavings and the improper distribution of them in the boxes, the washing of tailings with sump solutions instead of clean water, etc., are responsible for this loss, aggregating \$250,000 for every per cent. The discussions which ensued from the investigations made by Mr. James and Mr. P. S. Tavener have already produced beneficial results. Only recently it has been found, by the latter, that when running down the precipitation slimes as for an assay with litharge the recovery was fully 10 per cent more than by the ordinary calcination and acid treatment. "Discoveries" such as these come as a shock to those who expect every method in a mighty industry like that of the Rand to be founded on careful experiment. Capitalists are proverbially averse to costly experiments, but most proverbs are only true when turned inside out, and we believe that the leaders of Rand mining know well enough that experiments are the stepping stones to metallurgical progress.

At Kalgoorlie, notable success has been achieved in the treatment of telluride ores. Cyanidation of these refractory ores without previous roasting has been found applicable to low-grade material, although unsuitable to rich ores. This is very much like the first experience at Cripple Creek, where this method, however, was soon discarded, because it was found that calcina-

tion made the ore more amenable to leaching, and the subsequent filtering.

Ordinary stamp-milling with amalgamation on plates to extract the native gold, which is characteristic of the Kalgoorlie ores and quite distinct from the values contained in tellurides, will be followed by the removal of the heavy sulphides by concentration, with subsequent roasting, re-grinding and cyanidation, aided by the filter-press. The tailings, after the sulphides are removed, will undergo similar treatment minus the roasting. It is doubtful whether bromocyanide, which is the chief feature of the Diehl process, will be generally adopted. At the Lake View Consols Mill the treatment has been so improved that the cost is now only 19 shillings or less than \$5 per ton, a result, it must be remembered, obtained in a locality where power costs \$22.50 per horse-power per month, and water has to be paid for. At any of the better favored mining districts of this country this result would be equivalent to, say, \$3.50 per ton, a figure which is almost equal to the very best work now being done at the large milling establishments at Colorado City, which treat the ores of Cripple Creek, a material more docile, from a metallurgical standpoint, than that produced at Kalgoorlie.

The review of cyanidation in the United States indicates great activity in the metallurgical development of this process, especially in South Dakota, so long famous for the profitable treatment of very poor ores. In the reversion from dry to wet crushing, South Dakota is in accord with West Australia, while the employment of a very weak cyanide solution in lieu of the usual battery-water is another quite unique, return to the first experimental methods adopted, for example, in California, during the infancy of cyanidation, but discarded in the later development of the process. It will be curious to learn at the end of another year how this method has fared, when applied on a large scale for a sufficient period to test it adequately.

The fineness of crushing previous to cyanidation varies from over 100-mesh to as coarse as $\frac{1}{4}$ inch—a contrast which accentuates very strikingly the great diversity of the ores submitted to cyanide solutions. The early work done at Mercur, on oxidized ore having a porous limestone base, was successful when crushing to only 20-mesh and the ores were treated raw, or without previous roasting. Subsequently, when the product of the upper levels changed, in depth, to a clayey product which prevented filtration, it was found necessary to calcine, so as to get rid of the plasticity, and to follow this by making briquettes which facilitated leaching. Even then the sizing was only to $\frac{1}{8}$ -inch. In the Gilt Edge District, of Eastern Montana, the ores are also in limestone country, and near the surface they are so soft that, on crushing, they readily turn into a thick clay. Chilean mills crushing to $\frac{1}{4}$ inch were found to prepare the ore suitably for direct leaching. From these instances to the last resorts of perplexed millmen who attempted to treat hard siliceous ores by crushing dry, with rolls, to impalpable powder before they gave up the impossible, and reverted to wet crushing, there is a striking divergence of practice.

It is very evident that the cyanide process

has gained new territory during the past year and that its metallurgical possibilities are not nearly exhausted.

TO ENGINEERS VISITING NEW YORK.

A room for the exclusive use of visiting mining engineers is maintained at the New York office of THE ENGINEERING AND MINING JOURNAL. Visitors to the metropolis are cordially invited to take advantage of the facilities it offers, by having their mail addressed in care of the JOURNAL and making its office their headquarters. The managers of the branch offices will also be glad to welcome visiting engineers and to be of any service to them that they can.

ANNOUNCEMENT.

Mr. W. J. Johnston, as president of the ENGINEERING AND MINING JOURNAL, of New York, has bought the semi-monthly *Pacific Coast Miner*, of San Francisco, which will hereafter be published every Saturday as a separate paper by a separate company, but under a close working arrangement with the ENGINEERING AND MINING JOURNAL.

Mr. Johnston has remained in San Francisco in order to personally superintend the first issues under the new ownership. These will contain 40 pages, which is about double the former number. Twenty-four pages of this will be reading matter, and 16 pages will be advertisements.

The *Pacific Coast Miner* will be slightly reduced in size, so as to correspond with the pages of the ENGINEERING AND MINING JOURNAL, thus making it possible for advertisers to use the same announcement in both papers.

The issue of the *Pacific Coast Miner* for January 3, in addition to the regular news from special correspondents, will contain several valuable illustrated special articles by well-known Californians, including "A Review of the Mining Progress of Amador County," by Thomas D. Calkins; "Developing Abandoned Mother Lode Mines," by John B. Tregloan; "Niter, a Coming American Industry," and a preliminary report on recent experiments, made at the University of California, in the making of cyanide of potassium by a process which utilizes atmospheric nitrogen. There will also be a general review of the progress of the Mining Industry of the Pacific Coast for the year 1902.

The *Pacific Coast Miner* will aim to cover thoroughly the rapidly growing mining and metallurgical industries of the Western States, and no expense will be spared to attain this end.

The paper will be issued as a separate publication and will contain entirely different reading matter from that contained in the ENGINEERING AND MINING JOURNAL, but it will have a close working arrangement with the latter publication. Readers interested in the mining and metallurgical industries will be better served by one organization thoroughly equipped than by two organizations not so well equipped for the work.

Mr. Charles G. Yale, the Pacific Coast correspondent of the ENGINEERING AND MINING JOURNAL, and Mr. J. O. Denny, formerly editor of the *Pacific Coast Miner*, will act together as editors of the new paper.

The San Francisco offices of the two papers have been consolidated in large quarters in the well-known mining building, the Halleck Block, 320 Sansome Street, where the *Pacific Coast Miner* has long had its home. The telephone number is Bush No. 240, and the registered cable address is "Coastminer."

The subscription price of the *Miner* will be \$3 a year. For \$6 the *Pacific Coast Miner* and the ENGINEERING AND MINING JOURNAL will be sent for one year.

Mining men visiting the Coast are cordially invited to make the office of the *Pacific Coast Miner* their headquarters.

THE PRODUCTION OF MINERALS AND METALS IN THE UNITED STATES DURING 1902.

By JOSEPH STRUTHERS.

The value of statistical information pertaining to the mineral and metal output of a country depends largely upon its timeliness—a feature which is especially appreciated in the manufacturing industries based on the treatment of these products—and while it is practically impossible to obtain complete records of the total production until after the close of the year, a very close approximation can be obtained from the returns of producers and refiners for eleven months of the year, supplemented with an estimate, by them, for the concluding month.

Reasonably accurate annual statistics published in January of the following year are of much greater value to the practical man than final figures published six months or a year later; therefore, recognizing the importance of a prompt statement of the mineral and metal production of the United States, it has been the custom in previous years (excepting the year 1902) to publish in the first issue in the new year of the Engineering and Mining Journal, a table giving the preliminary statistics of the mineral and metal output for the year just closed. Absolute accuracy is not claimed for this information, but it is sufficiently close to answer all practical requirements, as is shown by a comparison of the preliminary statistical table which appeared in the Engineering and Mining Journal January 5, 1901, with the revised table published in The Mineral Industry July, 1901. The difference in the aggregate value of metals and non-metals was but \$22,495,241 in a total value of \$1,090,747,451, which corresponds to 2.1 per cent. Furthermore, this difference was on the side of conservatism, the preliminary figures being less than the final ones. In very few instances did the difference exceed 5 or 6 per cent, being greatest in such comparatively unimportant products as cannel coal, amorphous graphite, monazite sand, iridium and nickel from domestic ores, the aggregate value of which amounted to \$152,578 only, a sum so small when compared to the total as to be almost negligible. On the other hand, in many important industries, the difference in value was less than 2.5 per cent; for instance, in the values of gold, silver, petroleum and bituminous coal, which aggregated 40 per cent of the grand total, the differences were respectively 0.6, 1.4, 1.5 and 2.3 per cent, while in pig iron it was less than 0.5 per cent.

It is accepted as a fact that much of the re-

markable progress in special lines of metallurgy in this country has been due largely to a hearty spirit of co-operation even among rivals; each and every earnest worker has contributed to the general fund of practical knowledge, and each individual gift has been well repaid by the benefit derived from the sum total of the information supplied by all. Similarly, in the collection of statistics, producers are interested in having timely reports and in many instances they have gone to considerable expenditure of time and trouble to furnish the information requested. To this large body of workers our sincere thanks are herewith publicly given for the cordial co-operation which has been almost universally extended to us.

The accompanying table gives the statistics of the production of minerals and metals from domestic ores in the United States during the year 1902, the quantities being expressed in customary measures and in metric tons, while the values are given in dollars and in unit value per metric ton or kilogram in order to facilitate comparison with other statistical reports. In those industries which are spread over large areas of the country and number hundreds and even thousands of individual producers—as, for instances, coal and clay—it has not been deemed advisable to conduct a preliminary canvass, and the final figures have been based upon estimates prepared by many of the principal producers and railroad companies. With very few exceptions the statistics for 1902 have been obtained by direct canvass of the producers, and in this connection it is extremely gratifying to note that the aim and scope of this work are being better appreciated every year, and the reports have been given more and more freely and in greater detail than ever before.

To indicate the progress in the many branches of the mineral and metal industries of the country the table includes also the statistics of production for the year 1901, which have been compiled mainly from the reports of the United States Geological Survey. Due credit is hereby acknowledged to that important branch of government service for the information so used.

The statistics of the production of gold, pig iron, lead, nickel, quicksilver, aluminum and zinc during 1902, will closely approximate the final statistics collected later in the year as in nearly all cases the reports furnished embrace at least eleven months of the year.

The statistics of the production of copper are the same as those collected by Mr. John Stanton, the statistician of the Associated Copper Companies, with the exception that an addition has been made of the copper contained in the quantity of copper sulphate produced during the year, for which very complete returns have been furnished by the producers; consequently, as Mr. Stanton does not include these figures, the revised statistics of the production of copper will exceed those reported by him. The statistics of the production of gold have been compiled from the reports of the crude bullion refiners, supplemented by the quantity of gold contained in argentiferous matte and ingot copper which has been exported during the year.

Revised statistics of the production of minerals and metals in the United States during 1902

will be published in our annual volume, The *Mineral Industry*, later in the year, which will contain fuller details than is possible to give here, accompanied by complete reviews of the progress that has been made in the various branches of the mineral and metal industries of the world, as well as valuable technical articles on special subjects selected with a view to aid the practical worker. By this combination both the urgent needs of business men on the one

year to year as our preliminary statistics become nearer complete. Included under these substances is the subjoined table are corundum, diatomaceous earth, emery, grindstones, quartz crystal, tripoli, whetstones, alum and aluminum sulphate, asphaltum and bituminous rock (not including gilsonite), calcium carbide, borax, clay and clay products, gypsum, mica, natural gas, iron oxides, sand, silica, soapstone, precious stones, sulphuric acid, and manganese, molybdenum, uranium, tungsten and vanadium ores.

contained in hard lead was 5,034,000 pounds, valued at \$351,217, as compared with 4,470,000 pounds, valued at \$457,150 in 1901, the increase from all sources amounting to 10 per cent. The importation of regulus or metal into the United States for the eleven months ending November, 1902, amounted to 5,316,337 pounds, valued at \$321,328, as compared with 3,347,372 pounds, valued at \$233,865 in 1901. The regulus or metal re-exported amounted to 37,184 pounds, valued at \$2,710 in 1902.

MINERAL AND METAL PRODUCTION OF THE UNITED STATES FROM DOMESTIC ORES.

	1901.				1902.			
	Quantity.	Metric tons	Value at Place of Production.	Per metric ton	Quantity.	Metric tons	Value at Place of Production.	Per metric ton
	Customary measures.	or kilograms.	Totals.	or kilogram.	Customary measures.	or kilograms.	Totals.	or kilograms.
Non-metallic.								
Arsenic, white	Sh. T. 300	272	\$18,000	\$66.18	2,400	2,176	\$144,000	\$66.18
Asbestos	Sh. T. 747	678	13,498	19.91	1,010	917	15,400	16.79
Barytes	Sh. T. 49,070	44,528	157,844	3.54	50,000	45,359	162,500	3.58
Bauxite	L. T. 18,905	19,214	79,914	4.16	25,800	26,213	109,046	4.16
Bismuth Ore (5 % Bi.)	Sh. T. 319	289	25,488	88.19	20	18	1,500	83.33
Bromine	Lb. 552,023	250	154,572	618.19	523,918	237	130,980	552.66
Carborundum	Lb. 3,838,175	1,741	345,435	198.41	3,800,000	1,724	342,058	198.41
Cement, nat. hydraulic	Bbl. (300 lb.) 7,084,823	963,921	3,056,278	3.17	7,000,000	952,538	3,360,000	3.53
Cement, Portland	Bbl. (400 lb.) 12,711,225	2,306,756	12,532,360	5.43	15,500,000	2,812,301	24,935,624	8.86
Cement, from slag	Bbl. (400 lb.) 272,689	49,490	346,430	7.00	768,829	139,495	1,100,124	7.89
Coal, anthracite	Sh. T. 67,471,667	61,209,889	112,504,020	1.84	45,071,667	40,888,748	82,931,867	2.02
Coal, bituminous, includes cannel	Sh. T. 225,826,849	203,960,574	236,406,449	1.16	248,226,849	225,189,912	295,389,950	1.32
Coke	Lb. 21,789,945	19,773,090	44,431,522	2.25	23,968,939	21,750,399	61,118,621	2.81
Cobalt oxide, from domestic ores	Lb. 13,350	kg. 6,062	24,048	kg. 3.97	nil.	7,947	31,550	3.97
Cobalt oxide, from foreign ores	Lb. 78,004,257	35,282	3,674,000	104.13	48,120,586	21,827	2,045,125	93.69
Copper sulphate, includes by-prod't prod'n.	Sh. T. 23,586	21,397	112,366	5.25	18,300	16,593	91,500	5.25
Copperas	Sh. T. 345	313	37,950	121.25	367	333	51,450	154.50
Crushed steel	Sh. T. 19,586	17,773	113,803	6.40	26,311	23,869	131,555	5.51
Fluorspar	Sh. T. 14,112	12,802	96,835	7.57	15,183	13,773	102,757	7.46
Garnet	Sh. T. 4,444	4,033	158,100	39.20	4,566	4,142	144,970	35.00
Graphite, amorphous	Sh. T. 809	734	31,800	43.32	3,336	3,026	76,920	25.42
Graphite, crystalline	Lb. 3,967,612	1,800	135,914	75.51	4,331,824	1,965	165,255	84.10
Graphite, artificial	Lb. 2,500,000	1,134	119,000	104.94	2,351,491	1,067	111,251	104.26
Iron ore	L. T. 28,887,479	29,359,325	49,256,245	1.60	34,814,000	35,371,024	57,443,100	1.62
Lead, white	Sh. T. 100,787	91,433	11,252,653	123.07	116,380	105,587	12,215,025	115.72
Lead, red	Sh. T. 13,103	11,887	1,448,550	121.95	13,330	12,546	1,437,054	114.54
Lead, orange mineral	Sh. T. 1,087	986	224,667	227.86	1,186	1,076	230,428	214.15
Limestone flux	Lb. 8,540,168	8,679,656	4,659,836	0.54	9,543,074	9,695,763	5,235,712	0.54
Litharge	Sh. T. 9,460	8,582	979,586	114.14	10,866	9,858	1,057,696	107.29
Magnesite, crude	Sh. T. 13,172	11,949	43,057	3.60	3,386	3,072	21,452	6.98
Mineral wool	Bbl. (42 gal.) 6,002	5,445	60,320	11.08	10,843	9,866	105,814	10.76
Petroleum, crude	L. T. 69,389,194	8,839,263	66,417,335	7.51	75,652,919	10,583,843	65,761,604	6.21
Phosphate rock	L. T. 1,483,723	1,507,463	5,316,403	3.53	1,580,997	1,606,293	5,338,065	3.32
Pyrites	L. T. 234,825	238,661	1,024,449	4.29	303,746	308,606	1,194,064	3.87
Salt, includes salt used for alkali m'fr.	Bbl. (280 lb.) 20,506,661	2,613,299	6,617,449	2.53	22,749,525	2,889,353	8,747,761	3.03
Soda, manufactured	Sh. T. 480,000	8,318,400	17.33	.....	528,000	9,477,600	17.95	.....
Sulphur	Sh. T. 7,690	6,978	223,430	32.02	12,116	10,991	343,967	31.29
Zinc, white	Sh. T. 46,500	42,185	3,720,000	88.18	47,821	43,383	3,648,740	84.11
Zinc ore, exported	Sh. T. 44,156	40,658	1,167,684	29.15	51,802	46,994	1,517,277	32.29
Zinc, lead	Sh. T. 2,500	2,288	150,000	66.14	4,000	3,629	225,000	62.00
Other products unspecified	.....	.....	220,956,145	.....	.....	.....	240,000,000	.....
Total, non-metallic	.....	.....	\$796,411,835	.....	.....	.....	\$886,694,362	.....
Metallic.								
Aluminum	Lb. 7,150,000	3,243	2,238,000	659.26	7,300,000	3,311	2,284,590	6.69
Antimony, from domestic ores	Lb. 100,000	46	10,383	225.71	.....	.....	.....	.....
Antimony, in hard lead	Lb. 4,470,000	2,028	457,150	225.42	5,034,000	2,283	351,217	153.84
Copper	Lb. 609,173,212	276,319	87,300,515	315.94	669,855,006	303,844	78,630,453	258.78
Gold	Troy oz. 3,805,500	kg. 114,945	78,666,700	kg. 664.60	4,243,357	kg. 131,968	87,710,189	kg. 664.60
Iron, pig	L. T. 15,878,354	16,132,408	242,174,000	15.01	17,740,574	18,024,423	310,460,045	17.23
Iridium, from domestic ores	Troy oz. 253	kg. 8	5,060	kg. 641.75	20	.....	400	.....
Lead	Sh. T. 270,700	245,644	23,280,200	94.77	257,517	242,690	21,770,534	89.61
Nickel, from domestic ores	Lb. 6,700	kg. 3,040	3,551	kg. 1.17	.....	.....	.....	.....
Platinum, from domestic ores	Troy oz. 1,408	kg. 44	27,526	kg. 625.59	358	.....	6,211	kg. 559.55
Quicksilver	Flask (76.5 lb.) 29,727	1,031	1,382,305	1,240.74	32,000	1,110	1,488,221	1,340.74
Silver	Troy oz. 55,214,000	kg. 1,717,155	32,548,653	kg. 18.95	67,152,958	kg. 2,091,567	35,067,275	kg. 16.79
Zinc	Sh. T. 140,822	127,788	11,205,760	88.16	158,447	143,742	14,380,650	100.04
Other metals unspecified	.....	.....	16,721,633	.....	.....	.....	17,000,000	.....
Total, metallic	.....	.....	496,081,436	.....	.....	.....	569,149,785	.....
Total, non-metals	.....	.....	796,411,835	.....	.....	.....	886,694,362	.....
Total, metals	.....	.....	496,081,436	.....	.....	.....	569,149,785	.....
Deduct duplications	.....	.....	\$93,629,061	.....	.....	.....	\$95,500,000	.....
Grand total	.....	.....	\$1,198,864,210	.....	.....	.....	\$1,360,344,147	.....
METALS PRODUCED FROM FOREIGN ORES AND BULLION.								
Antimony	Lb. 727,421	330	\$74,487	.....	517,325	235	\$46,559	.....
Copper	Lb. 102,645,963	kg. 46,520,209	16,536,265	.....	82,118,400	kg. 37,248,660	9,541,337	.....
Gold	Troy oz. 1,730,856	kg. 53,835	35,776,794	.....	1,771,320	kg. 550,881	36,613,184	.....
Lead	Sh. T. 22,260	kg. 20,194,272	1,927,716	.....	94,721	kg. 85,930,327	7,708,394	.....
Nickel	Lbs. 8,664,614	kg. 3,930,198	4,037,710	.....	9,742,397	kg. 4,419,000	4,968,622	.....
Silver	Troy oz. 45,410,085	kg. 1,412,404	27,850,005	.....	39,082,033	kg. 12,154,512	20,408,638	.....
Total	.....	.....	\$86,202,977	.....	.....	.....	\$79,286,734	.....
Grand total of value of mineral and metal production from both domestic and foreign sources	.....	.....	\$1,285,067,187	.....	.....	.....	\$1,439,630,881	.....

hand and the requirements of engineers, metallurgists, statisticians and statesmen on the other are best satisfied.

METALLIC AND NON-METALLIC SUBSTANCES IN 1902.
The grand total of the value of metallic and non-metallic substances produced in the United States from domestic ores during 1902, after allowing for duplications, was \$1,360,344,147, as compared with \$1,198,938,697 in 1901, an increase of 13 per cent for the year. The total value of metals was \$569,149,785, as compared with \$496,155,923, an increase of 15 per cent. The value of the production of non-metallic substances was \$886,694,362, as compared with \$796,411,835, an increase of 12 per cent.
The number of substances included under the heading of "other products not specified" decreases from

METALLIC PRODUCTS.
Aluminum.—The production in 1902 was 7,300,000 pounds valued at \$2,284,590 as compared with 7,150,000 pounds valued at \$2,238,590, an increase in value of 2.1 per cent. This entire output is controlled by a single company. The exports of aluminum and manufactures of aluminum during the first eleven months of 1902 amounted to \$110,937, as compared with \$178,448 during the corresponding period of 1901.
Antimony.—There was no production of metallic antimony from domestic ores in 1902, but from foreign ores there were produced 517,325 pounds of metal valued at \$46,559 as compared with 728,000 pounds valued at \$74,640 in 1901. The antimony

Copper.—The quantity of copper produced in 1902 was 669,855,006 pounds, valued at \$78,630,453, as compared with 609,173,212 pounds, valued at \$87,300,515. The quantity of metallic copper imported during the eleven months ending November, 1902, was 86,458,478 pounds, valued at \$11,126,329, as compared with 67,880,676 pounds, valued at \$10,800,430 during the corresponding period of the previous year.
The quantity of copper exported during the eleven months of 1902 amounted to 336,023,154 pounds, valued at \$41,179,887, as compared with 174,185,419 pounds, valued at \$28,554,028. The quantity of copper re-exported amounted to 11,180,897 pounds, valued at \$1,548,441 in 1902, as compared with 12,553,686 pounds, valued at \$2,090,233 in 1901.
Lead.—The quantity of desilverized, soft and anti-

monial lead amounted in 1902, to 183,704, 74,363, and 9,450 short tons respectively, as compared with 211,368, 57,898 and 10,656 short tons in 1901, the combined value being 21,770,534, as compared with \$23,280,200, a decrease of 6.5 per cent. The imports of lead for the first eleven months of 1902 amounted to 193,631,136 pounds valued at \$4,136,100, as compared with 211,846,198 pounds, valued at \$4,509,302 in 1901. The quantity of lead and manufactures of lead exported during eleven months of 1902 amounted to \$662,465, as compared with \$580,353 in 1901.

The quantity of lead re-exported during the first eleven months of 1902 was valued at \$3,355,963, as compared with \$3,861,016 in 1901.

Nickel.—There was no nickel produced from native ores during 1902. In 1901, the output of nickel amounted to 6,700 pounds, valued at \$3,551. The nickel produced from foreign ores in 1902 amounted to 9,742,297 pounds, valued at \$4,968,622, as compared with 8,664,614 pounds, valued at \$4,037,710, in 1901.

Pig-iron.—The output of pig-iron was the greatest annual production on record, and the United States continues to lead the world. During 1902, it amounted to 17,740,574 long tons, valued at \$310,460,045, as compared with 15,586,893 long tons, valued at \$232,800,328 in 1901, an increase of 33.36 per cent. The quantity of pig-iron imported during the eleven months ending November, 1902, was 507,010 short tons, valued at \$8,995,029, as compared with 53,289 tons, valued at \$1,496,954 in 1901.

The quantity of pig-iron exported during the eleven months was 26,277 short tons, valued at \$476,635, as compared with 75,843 tons, valued at \$1,172,379, in 1901.

Platinum.—A small quantity of platinum 358 ounces troy, valued at \$6,211 was produced from domestic ores in 1902, as compared with 1,408 ounces troy, valued at \$27,526 in 1901. Besides this production in 1902, 674 ounces troy were recovered from South American ores. The quantity of platinum imported during the first eleven months of 1902 was 6,467 pounds valued at \$1,766,869 (of which 16 pounds valued at \$4,074 were re-exported), as compared with 5,707 pounds, valued at \$1,540,351 in 1901. The quantity of iridium recovered during 1902 was only 20 ounces troy, valued at \$400, as compared with 253 ounces troy, valued at \$5,060, in 1901.

Quicksilver.—The total output of quicksilver during 1902, was 32,000 flasks, valued at \$1,488,221, as compared with 29,727 flasks, valued at \$1,382,305 in 1901, an increase of 7.66 per cent. The quantity of quicksilver exported during the first eleven months of 1902 was 942,980 pounds, valued at \$535,702, as compared with 753,612 pounds, valued at \$424,002 during the corresponding period of the previous year.

Gold.—The production of gold from domestic ores during 1902 amounted to 4,243,357 troy ounces, valued at \$87,710,189, as compared with 3,880,578 ounces, valued at \$80,211,547 in 1901. In addition to the production from domestic ores there were produced from foreign ores during 1902 1,771,320 ounces, valued at \$36,613,184, as compared with 1,730,856, valued at \$35,776,793 in 1901. The imports of gold during the eleven months ending November, 1902, were \$42,006,396, as compared with \$51,970,358 in the corresponding period of 1901. The exports of gold for eleven months in 1902 amounted to \$33,177,904, as compared with \$53,039,816 in the eleven months of 1901.

Silver.—The production of silver from domestic ores during 1902 amounted to 67,152,958 ounces troy, valued at \$35,067,275, as compared with 55,215,253 ounces, valued at \$32,549,392 in 1901, an increase of 22 per cent. In addition to the production from domestic ores, there were produced from foreign ores and bullion 39,082,033 ounces, valued at \$20,408,638 in 1902, as compared with 45,410,085 ounces, valued at \$23,669,245 in 1901. The quantity of silver imported during the first eleven months of 1902 was valued at \$23,701,933, as compared with \$28,358,192 in corresponding time 1901. During the same period there was exported \$43,728,964, in 1902, as compared with \$50,914,919 in 1901.

Zinc.—There was an increase of 27.65 per cent in the production of zinc, the output in 1902 amounting to 158,447 short tons, valued at \$14,380,650, as compared with 140,822 short tons, valued at \$11,265,760, in 1901. During the eleven months ending November, 1902, the importation of zinc and manufactures of zinc amounted in value to \$74,247, as compared with \$66,647 in 1901. The exports of zinc and manufactures of zinc during the same period in 1901 amounted to \$402,345, as compared with \$321,804 in 1901.

NON-METALLIC PRODUCTION.

Arsenic.—The production of white arsenic in 1902 amounted to 2,400 short tons, valued at \$144,000, as compared with 300 tons, valued at \$18,000 in 1901.

Asbestos.—The production of asbestos in 1902 was 1,010 short tons, valued at \$15,400, as compared with 747 tons, valued at \$13,498 in 1901, an increase in value of 14.09 per cent.

Barytes.—The output of barytes in 1902 was approximately 50,000 short tons, valued at \$162,500, as compared with 49,070 tons, valued at \$157,844 in the previous year, an increase of 2.94 per cent.

Bauxite.—The production of bauxite in 1902 was 25,800 long tons, valued at \$109,946, as compared with 18,905 tons, valued at \$79,914 in 1901, an increase of 36.45 per cent.

Bromine.—The production of bromine in 1902 was 523,918 pounds, valued at \$130,980, as compared with 552,023 pounds, valued at \$149,045 in 1901, a decrease of 12.12 per cent.

Carborundum.—The output of carborundum in 1902 amounted to 3,800,000 pounds, valued at \$324,058, as compared with 3,838,175 pounds, valued at \$345,435 in 1901, a decrease of 6.16 per cent.

Cement, Natural Hydraulic.—The production of natural hydraulic cement during 1902 was 7,000,000 barrels, valued at \$3,360,000, as compared with 7,084,823 barrels, valued at \$3,056,278 in 1901, an increase in value of 9.93 per cent.

Cement, Portland.—The production of portland cement has shown a large increase, the output being 15,500,000 barrels, valued at \$24,935,624 in 1902, as compared with 12,711,225 barrels, valued at \$12,532,360 in 1901, an increase in value of 98.97 per cent.

Cement from Slag.—The production of cement from slag during 1902 also showed a very large increase, the output being 768,829 barrels, valued at \$1,100,124, as compared with 272,689 barrels, valued at \$346,430 in 1901, an increase in value of 217.56 per cent.

For the eleven months ending November, 1902, the imports, exports and re-exports of Ro-

man, Portland and other hydraulic cements were as follows: Imports, 719,115,562 pounds, valued at \$2,348,673; exports, 332,280 barrels, valued at \$510,212; re-exports, 12,521,015 pounds, valued at \$47,241, as compared with imports, 344,708,649 pounds, valued at \$1,185,814; exports, 349,830 barrels, valued at \$632,147; re-exports, 15,437,874 pounds, valued at \$66,319, during the corresponding period in 1901.

Coal and Coke.—The production of anthracite coal amounted to 45,071,667 short tons, valued at \$82,931,867, as compared with 67,471,667 tons, valued at \$112,504,020, in 1901, a decrease of 26 per cent. The production of bituminous coal amounted to 248,226,849 short tons, valued at \$295,389,950, as compared with 224,869,091 tons, valued at \$236,309,811, an increase of 25 per cent. The output of coke amounted to 23,968,939 short tons, valued at \$61,118,621, as compared with 21,789,945 tons valued at \$44,431,522, an increase of 37 per cent.

The quantity of anthracite and bituminous coal imported in the eleven months ending November, 1902, amounted to 2,234,526 short tons, valued at \$6,324,558, as compared with 1,757,788 short tons, valued at \$4,855,715, during the corresponding period in 1901. The quantity of coal and coke exported during these eleven months in 1902 was 6,056,908 tons, valued at \$18,330,572 as compared with 7,293,403 tons, valued at \$22,124,162 during the corresponding period in 1901.

Copper Sulphate.—The production of copper sulphate in 1902 was 48,120,586 pounds, valued at \$2,045,125, as compared with 78,004,257 pounds, valued at \$3,674,000 in 1901, a decrease in value of 44.3 per cent. The copper-sulphate exported during the first eleven months of 1902 amounted to 30,128,845 pounds, valued at \$1,202,530, as compared with 47,345,391 pounds, valued at \$2,236,632 in 1901.

Copperas.—The production of copperas in 1902 amounted to 18,300 short tons, valued at \$91,500, as compared with 23,586 tons, valued at \$112,366 in 1901, a decrease in value of 18.57 per cent.

Crushed Steel.—The output of this substance in 1902 was 367 short tons, valued at \$51,450, as compared with 345 tons, valued at \$37,950 in 1901, an increase in value of 35.58 per cent.

Fluorspar.—The production of fluorspar in 1902 was 26,311 short tons, valued at \$131,555, as compared with 19,586 tons, valued at \$113,803 in 1901, an increase in value of 15.59 per cent.

Fuller's Earth.—The output of fuller's earth in 1902 was 15,183 short tons, valued at \$102,757, as compared with 14,112 tons, valued at 96,835 in 1902, an increase in value of 6.11 per cent.

Garnet.—The production of this mineral in 1902 was 4,566 short tons, valued at \$144,970, as compared with 4,444 tons, valued at \$158,100, in 1901, a decrease in value of 8.30 per cent.

Graphite, Amorphous.—The production of amorphous graphite during 1902 was 3,336 short tons, valued at \$76,920, as compared with 809 tons valued at \$31,800 in 1901, an increase in value of 141.88 per cent.

Graphite, Artificial.—The single producer of this substance reports an output in 1902 of 2,351,491 pounds, valued at \$111,251, as compared with 2,500,000 pounds, valued at \$119,000, for the previous year, a decrease in value of 6.51 per cent.

Graphite, Crystalline.—The production of crystalline graphite in 1902 amounted to 4,331,824

pounds, valued at \$165,255, as compared with 3,967,612 pounds, valued at \$135,914 in 1901, an increase in value of 21.59 per cent.

Iron Ore.—The total production of iron ore was 34,814,000 long tons, valued at \$57,443,100, as compared with 28,887,497 tons, valued at \$49,265,245, an increase in value of 16.60 per cent. The amount of iron ore imported during the eleven months ending November, 1902, was 1,063,025 short tons, valued at \$2,363,509, as compared with 887,337 tons, valued at \$1,523,262 in eleven months in 1901. The amount of iron ore exported during this period was 87,210 tons, valued at \$290,796, as compared with 64,558 tons, valued at \$162,906 in the corresponding period of 1901.

Lead Pigments.—The production of white lead in 1902 was 116,389 short tons, valued at \$12,215,025, as compared with 100,787 tons, valued at \$11,252,653, in 1901, an increase in value of 8.55 per cent. The output of red lead was 13,830 short tons, valued at \$1,437,054, as compared with 13,103 tons, valued at \$1,448,550, a decrease in value of 0.79 per cent. The output of orange mineral was 1,186 short tons, valued at \$230,428, as compared with 1,087 tons, valued at \$224,667, an increase in value of 2.56 per cent. The output of litharge was 10,866 short tons, valued at \$1,057,696, as compared with 9,460 tons, valued at \$979,586, in 1901, an increase in value of 7.97 cent.

Limestone Flux.—The production of limestone flux in 1902 was 9,543,074 long tons, valued at \$5,235,712, as compared with 8,540,168 tons, valued at \$4,659,836 in 1901, an increase in value of 12.36 per cent.

Magnesite.—A total of 3,386 short tons of crude magnesite valued at \$21,452, was produced in California in 1902, as compared with 13,172 tons, valued at \$43,057 in 1901, a decrease in value of 50.18 per cent.

Mineral Wool.—The production of mineral wool in 1902 was 10,843 short tons, valued at \$105,814, as compared with 6,272 tons, valued at \$68,982, an increase in value of 53.39 per cent.

Petroleum.—The output of crude petroleum in 1902 was 75,652,919 barrels, valued at \$65,761,604, as compared with 69,389,194 barrels, valued at \$66,417,335 in 1901, a decrease in value of 0.99 per cent. The quantity of crude oil imported during the first eleven months of 1902 was 4,003,259 gallons, valued at \$231,466, as compared with 2,027,893 gallons, valued at \$136,158, in the corresponding period in 1901. The quantity of crude oil exported during the corresponding period in 1902 amounted to 128,499,130 gallons, valued at \$5,676,783, as compared with 115,527,011 gallons, valued at \$5,459,657, in eleven months of 1901.

Phosphate Rock.—The output of this mineral in 1901 amounted to 1,580,997 long tons, valued at \$5,338,065, as compared with 1,480,358 tons, valued at \$5,354,022, in 1901, a decrease in value of 0.29 per cent.

Pyrites.—The production of pyrites in 1902 was 303,746 long tons, valued at \$1,194,064, as compared with 234,825 tons, valued at \$1,024,449, in 1901, an increase in value of 16.56 per cent.

Salt.—The quantity of salt, including that used in the manufacture of alkali, in 1902, was 22,749,525 barrels, valued at \$8,747,761, as compared with 20,566,661 barrels, valued at \$6,617,449, an increase in value of 32.19 per cent. The quantity of salt

imported during the eleven months ending November 30, 1902, was 343,486,639 pounds, valued at \$578,268, as compared with 349,493,979 pounds, valued at \$584,507, during the corresponding period in 1901. The quantity of salt exported during eleven months in 1902 was 9,580,349 pounds, valued at \$52,536, as compared with 18,337,042 pounds, valued at \$82,957, in 1901. The quantity of salt re-exported during eleven months in 1902 amounted to 1,904,359 pounds, valued at \$4,213, as compared with 3,403,706 pounds, valued at \$4,815 in the corresponding period of the previous year.

Soda.—The quantity of sodium salts manufactured in this country in 1902 was 528,000 metric tons, valued at \$9,477,600, as compared with 480,000 metric tons, valued at \$8,318,400, in 1901, an increase in value of 13.84 per cent. The imports of sodium salts during the eleven months ending November 30, 1902, were valued at \$6,160,020, as compared with \$5,997,664, in eleven months in 1901. The re-exports of sodium salts during the same period were valued at \$163,995, as compared with \$111,493 in eleven months of 1901.

Sulphur.—The output of this mineral in 1902 amounted to 12,116 short tons, valued at \$343,967, as compared with 7,690 valued at \$223,430, in 1901, an increase in value of 53.95 per cent. The quantity of sulphur imported during the eleven months ending November 30, 1902, was 153,870 tons, valued at \$2,975,630, as compared with 143,750 tons, valued at \$2,658,879 for the corresponding period in 1901. The quantity of sulphur re-exported during the eleven months in 1902 amounted to 1,253 tons, valued at \$28,024, as compared with 182 tons, valued at \$4,274, during the corresponding period in 1901.

Zinc Ore.—The quantity of zinc ore exported during the entire year is estimated at 51,802 short tons, valued at \$1,517,277, as compared with 44,156 tons, valued at \$1,167,687 for the entire year of 1901, an increase of 29.9 per cent.

Zinc Pigment.—The output of zinc white in 1902 was 47,821 short tons, valued at \$3,648,740, as compared with 46,500 tons, valued at \$3,720,000 in 1901, a decrease in value of 1.91 per cent. The exports of zinc white during the first eleven months of 1902 amounted to 9,923,359 pounds, valued at \$403,672, as compared with 8,507,260 pounds, valued at \$367,026 for the corresponding time in 1901.

Zinc Lead.—The production of zinc lead in 1902 was 4,000 short tons, valued at \$225,000, as compared with 2,500 tons, valued at \$150,000 in 1901, an increase in value of 50 per cent.

ANTIMONY IN 1902.

By JOSEPH STRUTHERS.

There was little if any metallic antimony produced from domestic ores in the United States during 1902, due to the tariff decision rendered April 22, 1902, whereby crude antimony (partially refined sulphide) which was formerly classed at 20 per cent ad valorem was placed on the free list. This condition of affairs renders extremely problematical the profitable smelting of antimony ores in this country. The production of antimony from domestic ores during 1901 amounted to but 50 tons, an extremely small quantity when compared with the total consumption of this metal in this country. During 1902 about 1,000,000 pounds of metallic antimony were obtained from imported ores, as compared with 727,421 pounds

in 1901. The excess of imports over exports of antimony ore for the ten months ending October, 1902, amounted to 1,119,469 pounds, as compared with an excess of 1,583,841 pounds for the corresponding ten months in 1901, while for antimony metal the excess for the ten months in 1902 was 4,865,913 pounds, as compared with 3,093,856 pounds for the corresponding ten months in 1901. The large increase in both imports and exports of antimony ore during 1902 has resulted from the peculiar condition of freight rates which were about 10 shillings from China to New York, and about 30 shillings from China to England; the freight rate from New York to England being about 10 shillings; considerable crude antimony was sent first to New York for transshipment to England, which was cheaper than the all-through freight rate.

The smelting and refining of antimony in the United States has been and is controlled by Mathison & Co., of London, having smelting works at Chelsea, Staten Island, New York, with whom is affiliated the Chapman Smelting Company, of San Francisco. Since the removal of the duty from crude antimony, the last named works has been shut down. It is very probable that from time to time small lots of domestic antimony ore will be offered for treatment in the United States, but under the present conditions it is doubtful if there will be any marked development in this branch of the metal industry.

A large part of the domestic demand for antimony metal, particularly for manufacture into anti-friction and similar alloys, is supplied in the form of antimonial or hard lead, which contains generally from 18 to 27 per cent of antimony; during 1902 there were produced in the United States as a by-product in the smelting of both foreign and domestic lead ores 2,460 short tons of antimony metal (valued at \$343,375), contained in 9,450 short tons of antimonial lead, as compared with 2,235 short tons (valued at \$310,000), contained in 10,656 short tons of antimonial lead produced in 1901.

THE ANTIMONY MARKET IN 1902.

Although the consumption of antimony in 1902 was probably as large as, if not larger than, in 1901, nevertheless the market was rather depressed throughout the year, values ruling considerably below the figures of the previous twelve months, and sales of anything but retail lots were difficult to effect.

The price of antimony is mostly dependent on the available supplies. When these are abundant a lower level prevails, and when they are scarce the reverse is the case.

Production on the Pacific Coast was practically nil, whilst that in the East has been rather irregular. Importations, however, have been heavy and show a large increase over 1901, as far as metal and regulus are concerned. The so-called outside brands, such as Italian, French, Japanese and Hungarian, have again made heavy inroads in the trade previously controlled by the standard English brands, such as Cookson's and Hallett's, partly on account of the fancy prices asked, especially for the former and partly on account of the improving quality of the cheaper grades.

The comparatively easy tone of the antimonial lead market also tended to restrict the demand for antimony as it kept manufacturers from preparing their own mixture.

The year opened with Cookson's selling at 10 cents, Hallett's 8¼, Hungarian, Italian, Japanese and U. S. Star at 7¼, but from month to month prices crumbled off, holders being very anxious to sell and only too willing to make concessions when it was a question of taking a fair-sized order. The market closes rather dull and depressed at the lowest quotations of the year, 8½ to 8¾ for Cookson's, 7 to 7½ for Hallett's, 6¾ to 6½ for Italian, French, Japanese, Hungarian and U. S. Star.

COPPER IN 1902.

By FREDERICK HOBART.

The production of copper in 1902 shows a considerable increase over the previous year. It may be said, however, that this increase is not beyond the normal growth of production in this country, if we examine the circumstances of the past two years. For the last ten or fifteen years copper production has shown an average growth of 8 per cent yearly. In 1901 this growth was suspended, owing to circumstances and the production showed a gain of not much more than 1 per cent. In 1902, however, there was a return to much more normal conditions, and the gain of 10 per cent made in that year really represented the increase which should have been spread out over the two years.

The following table shows the production, exports and approximate consumption of copper for the year. The figures for production are based upon the reports made by Mr. John Stanton, who acts as statistician for the associated companies, the output for December being estimated. The imports and exports for December are also estimated. The figures are in long tons, and we have added to the production of metallic copper the copper contained in that portion of our sulphate which is produced as a by-product in the refining works, and does not appear as metal:

Copper Production, Consumption, Imports and Exports.				
	1901.	1902.	Changes.	Per cent.
Total production	271,949	299,042	I. 27,093	10.0
Net imports	72,852	72,193	D. 659	0.9
Stocks, Jan. 1.....	41,541	94,009	I. 52,468	126.4
Total supplies	386,342	465,244	I. 78,902	20.4
Approx. consumption...	196,904	231,300	I. 34,396	14.9
Exports	95,429	168,936	I. 73,507	77.1
Total deductions	292,333	400,236	I. 107,903	23.9
Stocks, Dec. 31.....	94,009	65,008	D. 29,001	20.2

It will be seen that the consumption and exports together exceed the consumption by nearly 101,000 tons, this excess not only absorbing the large imports, but also the surplus stocks which existed on January 1. For the purpose of certain parties in the trade these stocks had undoubtedly been very largely exaggerated by carefully spread reports, and their presumed existence had operated as a heavy weight upon the trade. Under existing conditions it was impossible to prove the exact amount, which in many quarters was asserted to be as high as 200,000 tons, and although this was manifestly an exaggeration, the authority of the Geological Survey was, through an obvious error, lent to a calculation which put their figures as high as 150,000 tons. In the JOURNAL we strongly contested these figures, inclined to the more moderate view which is shown above. In August Dr. A. R. Ledoux, at the instance of some of his foreign correspondents, undertook a careful investigation of the actual stock on hand. With the means at his command he was undoubtedly able to approximate very closely to the actual condition of affairs. His report placed the total copper on hand, including all that in process of treatment, at 62,165 tons. These figures were generally accepted as being as close to the truth as could be obtained, and from our report given above they have not been further increased. A careful inquiry toward the end of the year shows that the stocks at the present time are not in excess of the normal quantity which must always be carried and which approximates two months' production. Consumers, generally, are not well supplied. Few of them have any considerable amount ahead of their requirements for immediate consumption. Sellers, generally, have not any considerable quantities on hand which are not covered by contract for future delivery, and it may be assumed that there is no considerable quantity of spot copper available.

The consumption reported above is necessarily estimated in part, but we believe that the figures given represent a very conservative quantity, and, in fact, some high authorities in the

trade are inclined to place it on a higher figure than that which we have given. The stocks reported, approached closely to what may be called the normal reserve.

The greater part of the gain in production came from two sources; the first being the Lake Superior District where there was a gain of approximately 21,000,000 pounds, largely from the new mines, which first began to produce to any extent during the past year. The second was from the Utah mines, where several of the copper companies in the Bingham District have assumed considerable importance. The Highland Boy, the Bingham Consolidated and others, have become producers this year on a considerable scale, and it appears that from this time on Utah will have to be counted as a strong factor in copper production.

The Montana production has been restricted to some extent by the continuance of the litigation between the Boston & Montana and the Butte & Boston on the one hand and the Montana Ore Purchasing Company on the other. The conditions prevailing in that region are fully explained in the review of Montana, which will be found on the succeeding page.

In Arizona production was reduced to some extent by the closing of the United Verde Mine during the last quarter of the year on account of fire and caves and the general bad condition of the workings. This mine, apparently, cannot be a large producer for some months to come, and since almost an entire reconstruction of the mine is imperative before it can be worked on an extensive scale.

In the outside districts generally, and in the quantity of copper obtained from ores in which silver and other metals constituting the chief value, there was a considerable gain during the year, and there is every reason to suppose that this gain will continue during 1903.

The very high imports of copper have been due largely to the quantity of black copper and matte sent here from Mexico to be refined, and to the heavy shipments of copper ore to the Northport smelter, and to the quantity of British Columbia matte which has come to our refiners. Some allowance must also be made for Chilean copper imported on the Pacific Coast, in the form of ores and matte, and to the black copper from Tasmania, which is shipped to Baltimore for refining under the contract made with the Mount Lyell Company. Large as these imports were, they did not increase the stocks or do much more than make up the requirements of our own consumption.

Europe was a large buyer of our copper in 1902. The exports for that year, while they did not quite equal the record made in 1900, show an increase of 77 per cent over those for 1901. Notwithstanding the somewhat depressed condition of the electrical and other industries abroad, this copper seems to have been for the most part absorbed since no large increase in the visible stocks in Europe is known, and since the demand for copper for foreign account has continued unabated up to the close of the year.

Consumption in the United States was undoubtedly on the largest scale that has ever been known. Manufacturers using copper have all been busy throughout the year. Apart from the manufacturers of sheet and other forms of copper and of brass in the Naugatuck Valley and elsewhere, there has been a large, steady demand for copper throughout the year from the locomotive builders, the railroads, the steam engine builders, the car builders, and others. Estimates naturally vary a little, but all unite in putting consumption at a high figure, and we believe that the estimate given in the table above is a very conservative one.

It may be said that as the year opens the market has passed beyond the control of those influences which sought to depress it throughout 1902, and that the attempt to secure absolute

domination over the copper trade has failed, at any rate, for the present. In spite of the rumors which have been industriously circulated, there is no doubt that the leading independent producers are further from an agreement with the Amalgamated interests than at any time during the year. The attempt to coerce them into such an agreement by curtailing their profits has apparently failed, and even in some of the companies which have been supposed to be closely allied to the Amalgamated, movements are on foot for a change of management, which in some companies promise success. Moreover, it seems altogether probable that an understanding between the Amalgamated interests here and the group represented by the Rio Tinto in Europe, which might have been considered possible a year ago, is now far from probable.

THE NEW YORK COPPER MARKET IN 1902.

The course of the market during 1902 was very interesting in a good many respects and was again followed with marked attention on the part of those directly and indirectly connected with the industry, as well as by the general public.

In view of the erratic policy pursued by one of the largest factors in forcing the output of its mines after having accumulated large stocks, and in selling its copper in a manner surprising and inexplicable to the more conservative business men in the trade, the impression gained firm footing that the policy inaugurated last December was to be continued indefinitely, that is, to bring the price down to a very low level and keep it there at all hazards. There was comparatively slight resistance to this movement from Europe, where business throughout 1901 was rather disappointing, and traders there took full advantage of this carefully nursed specter, depressing prices long before our manufacturers awoke to the fact that a further heavy decline was imminent. However, the course of events made it apparent to the more experienced authorities in the trade on this side that in view of the very large consumption in the United States, the popular estimates of the available supplies were wildly inaccurate, all signs pointing to a rapid decline of the stocks on hand.

It is true, production shows an increase, in spite of the prevailing low prices. A number of new mines have started active operation. On the other hand, all the copper consuming industries have been exceedingly busy throughout the year. The brass as well as sheet mills have taken heavy quantities of copper. The railroads had to replenish their rolling stock, which was acknowledged to be inadequate. The ship-building industry was very prosperous, and last but not least, enormous quantities have been sold for electrical purposes.

The use of copper for traction purposes seems to have only just started. The railroads in the large capitals of Europe have already for some time past been run by electricity, while the Elevated Road in New York introduced this system only during the summer of 1902; and though there have been some serious drawbacks to successful transportation during inclement weather, there are signs of a rapid expansion of electric traction, not only on the smaller roads, such as the Underground and Elevated in New York, but also on the regular trunk lines.

The New York Central Road has already agreed to use electric power from Croton to their terminal depot at Forty-second Street, New York, a distance of some 40 to 45 miles, and the Pennsylvania Railroad is contemplating the same in the proposed tunnels which are to connect Manhattan Island with the Jersey coast on the one side and Long Island on the other.

This is evidently only a forecast of the use of electricity for long distance travel, and experiments in that direction are continually being made on both sides of the Atlantic.

At the beginning of the year the greatest uncertainty prevailed in the copper market, and it was evident that the retrograde movement which had

commenced in November, 1901, had not yet terminated. Prices opened nominally for lake at 12 cents, electrolytic at 11¾, but very soon a further cut of 1 cent was made, followed by quite large sales at the parity of 10½ and 10½, respectively, at which figures consumers at last operated freely and speculators were not slow to take an interest in the markets, trying to contract for whatever they could lay their hands on.

This enormous buying sufficed to put an end to the forced depression in prices which had been systematically worked for the two previous months, and the moment it was felt that prices had about reached bottom, consumers who had allowed their supplies to drop to the lowest ebb, purchased very largely, not only for prompt delivery but also as far ahead as they possibly could.

The interests which had been instrumental in forcing prices down were evidently unable to withstand the flood of orders pouring in from all sides. Quotations advanced quickly to 12½ or lake and 12¼ for electrolytic, ruling at these figures for several weeks. That this advance had been too rapid was evident, and as soon as some speculators tried to realize, the market commenced to ease off, and since that time there have been persistent efforts on the part of the largest operators to establish lower prices for copper wherever possible.

During May Lake copper declined to 12¼ and electrolytic to 12 cents, at which figures the market was fairly steady throughout June, but in July the coal strike caused manufacturers to proceed cautiously and restrict purchases. Consequently, values suffered and by the end of August had declined to 11¾ for lake and 11½ for electrolytic copper.

September proved fairly steady, but in October the flat tendency of the Stock Exchange and the unsettled state of affairs in the coal regions, coupled with renewed efforts on the part of leading interests to establish a lower range of values, tended to influence the market adversely. With the exception of a short-lived upward movement toward the end of the month, dullness reigned supreme for a considerable time, prices dropping slowly, until 11½ for lake and 11¼ for electrolytic was quoted at the end of November.

The settlement of the coal strike and a large inquiry from Europe, where business at last showed signs of improvement, and a good demand for home trade caused a buoyant feeling to prevail during December, to which prices quickly responded, the year closing with lake selling at 11¾ to 12 cents; electrolytic at 11½ to 11¾ cents; and casting copper at 11½ cents. The tendency was, moreover, apparently to a further advance.

Average Prices of Copper.

Month.	New York		Lake.		London Standard.	
	Electrolytic.	1901.	1902.	1901.	1902.	1901.
January	11.053	16.25	11.322	16.77	48.43	71.78
February	12.173	16.38	12.375	16.90	55.16	71.17
March	11.882	16.42	12.188	16.94	53.39	69.54
April	11.618	16.43	11.986	16.94	52.79	69.61
May	11.856	16.41	12.226	16.94	54.03	69.60
June	12.110	16.38	12.360	16.90	53.93	68.83
July	11.771	16.31	11.923	16.61	52.89	67.60
August	11.404	16.25	11.649	16.50	51.96	66.34
September	11.480	16.25	11.760	16.54	52.68	65.97
October	11.449	16.45	11.722	16.60	52.18	64.11
November	11.288	16.224	11.533	16.33	51.03	64.51
December	11.430	13.845	11.599	14.36	50.95	62.34
Year	11.626	16.117	11.887	16.53	52.46	66.79

New York prices are in cents, per pound; London prices in pounds sterling, per long ton of 2,240 lbs., standard copper. The prices for electrolytic copper are for cakes, ingots or wire bars; prices of cathodes are usually 0.25 cent lower.

The outlook for next year is rather encouraging. While rumors of a combination of the more important interests are no doubt without foundation, it is only natural that a clearer conception of the actual cost of production, the effect of the unskillful manner in marketing the production and the declining grade of the ore mined—not to speak of the decline in silver—should produce a more conciliatory frame of mind in some of the larger producers. It has again been shown that attempts to control the price and output of copper by artificial means are bound to

prove a failure. The law of supply and demand will ultimately govern the price of any staple article, and if it is allowed to govern the course of copper during the coming year, there is no doubt but what the result will be satisfactory to all concerned.

ARIZONA COPPER MINES IN 1902.

By JAMES DOUGLAS.

The record for Arizona for 1903 does not promise any great increase in output.

As to new works: In November, 1902, the works of the Calumet & Arizona Company at Douglas, whose mines are adjacent to those of the Copper Queen at Bisbee, were started with an output of from 20 to 25 tons a day, a production which will be increased during 1903. The Shannon Company in the Clifton District, which closed its smelters after a short campaign in 1902, in order to supplement its smelting works by a concentrator of 500 tons capacity daily, will resume operations before the close of 1903, and should make an output of at least 300 tons of copper a month. The Valverde Company on the Agua Fria, in Yavapai County, is running a furnace and making a copper matte rich in the precious metals. And the Black Diamond Company, operating in the Dragoon Mountains, expects to start a 100-ton furnace early in 1903.

The older companies are showing neither symptoms of decay nor of hysterical activity. The new Copper Queen works at Douglas should start during the summer of 1903, and are being designed to take custom ores of copper, gold and silver, as well as a slightly larger tonnage from the company's own mines. They are being supplied with large furnaces and good engines, and planned so as to handle large quantities of fuel and ore by machinery. The removal of the works to a distance of 28 miles from the mines is in order to secure space for an enlarged and better designed smelter, water for high-class condensing engines, nearer proximity to fuel, and a location more central to the mines of the Phelps-Dodge properties, and for the purchase of ores from Mexico and the Southwest. Though there is no intention of invading the market for lead, it is the intention of the company to enrich the copper bullion with gold and silver. The completion of the El Paso & Southwestern Railroad, and the penetration of the Nacozari Railroad into Sonora from Douglas, makes that growing town a favorable center for metallurgical works, which may hope to secure ores from Mexico, and from the reopened mines of Tombstone. These are being revived by the Development Company of America, and have been reached by a branch of the El Paso & Southwestern Railroad.

The prospects of Globe are better. Recent exploration in depth in the mines of the Old Dominion and the United Globe companies reveal sulphides in quantity of a grade that promises to give life to the mines, and, it is hoped, a better smelting mixture. But the output for 1903 will probably not exceed that for 1902.

The output of the United Verde Mines should be in excess, unless the fire breaks out afresh, or some other misfortune curtails operations.

Neither of the large companies in the Clifton District—the Arizona or the Detroit Company—is enlarging its plant, or will show an increase over the production of 1902. They are both aiming rather at increased efficiency in operation and lower cost of production than at making more copper, assured as they are, of the long life of their mines, and believing in the future value of the metal. The most promising features of the Bisbee group of mines is the discovery of profitable sulphide ore bodies in the deeper limestones, both in the property of the Copper Queen and the Calumet & Arizona companies, and the extension of the ore-bodies over a large area; but as they dip southward they occur unfortunately at great depths.

THE LAKE SUPERIOR COPPER MINING INDUSTRY IN 1902.

By OUR SPECIAL CORRESPONDENT.

The year 1902 was a trying one for the Lake Superior copper mining industry, but it was not without its successes. Begun under a cloud of uncertainty last year, and much of the haze of depression and unstableness has been dispelled. While some of the smaller mines of doubtful merit, foisted upon a willing public during a period of great prosperity, have succumbed to the inevitable and ceased operations, the older mines have demonstrated their ability to earn money on a low-priced metal market, and the new ones for weathering the storm until such time as they can be placed on a profitable basis. Altogether the outlook is exceedingly bright. The mines have withstood the low prices in a commendable manner, and the year 1903 should witness an increase in production and earnings.

Copper mining on Lake Superior was begun in 1844, and the first dividend was paid by the Cliff Mine five years later. Since that time the industry has passed through periods of great prosperity and undue depression, but dividends have been earned and paid in every year, no matter what the price of the metal.

The following table gives the production of refined copper in pounds by Lake Superior mines, for the past two years. The figures for 1902 are close estimates, the official figures not being obtainable until the latter part of next summer, but they will not vary much from the final amounts:

Copper Production of Lake Mines.

	1901.	1902.
Calumet & Hecla	74,510,557	80,000,000
Quincy	20,540,720	20,000,000
Tamarack	18,000,852	16,000,000
Osceola	13,723,541	11,000,000
Wolverine	4,947,980	6,150,000
Baltic	2,641,432	6,000,000
Trimountain	.....	6,000,000
Atlantic	4,666,889	5,000,000
Franklin	3,757,410	5,000,000
Champion	.....	4,250,000
Isle Royale	2,171,955	3,500,000
Mass	950,000	2,850,000
Mohawk	.....	1,150,000
Adventure	29,361	1,000,000
Arcadian	800,000	500,000
Phoenix	93,643	350,000
Michigan	.....	100,000
Centennial	806,400	.....
Miscellaneous	150,000	100,000
Total	147,790,740	168,950,000

The 1902 production of the Lake Superior copper district was the largest ever secured in its history. For six years, from 1896 to 1901, the production of the Lake District remained at a standstill. The high price of copper in 1899 induces the opening of a number of new mines and the resumption of work at several old ones. As it takes from three to five years' time and an immense amount of money to develop and equip a new property in this district, the mines which have entered the active list in the last half-decade had little effect on the total production until the year 1902. In fact, the increased production last year came almost entirely from the new mines. The 1902 product of the district would have been a great deal larger had it not been for the reduced output of some of the older mines. It was the policy of the Bigelow group of mines—the Tamarack, Osceola and Isle Royale—part of the year to curtail their production to influence the price of the metal. As long as these mines curtail their output the production of the Lake Superior District will not reach its just proportions.

The 1901 production of the Calumet & Hecla was the smallest made for several years. Even so rich a mine as the Calumet & Hecla has its ups and downs in production, and it is evident that the management, foreseeing the course of the metal market, took advantage to get out an immense amount of low-grade rock at a profit before the drop in the price of copper came.

Of the mines which entered the ranks of the producers in 1901 all may be expected to increase their output on a tremendous scale this year.

The Champion, Trimountain and Mohawk are all rich mines, with vast possibilities. None of the three are yet in possession of their full milling plants, but the remaining stamps will be put into commission as rapidly as possible. These three mines may be expected to make no less than 30,000,000 or 35,000,000 pounds of ingot copper this year. The Baltic is another new mine, which will greatly increase its output in 1903.

The number of men employed in the mines was never before so large as during the past year, and wages continued on the same scale as paid during a 17-cent copper market. There are now 15,000 men employed in the mines, mills and smelters of Houghton and Ontonagon counties, and probably an additional thousand in Keweenaw County, to the north. In other words, an increase of nearly 15 per cent in production last year was made with less than 5 per cent more men. The number of men employed in the Lake copper industry has nearly doubled in the short space of five years. In addition to the mines, mills and smelters, the labor force of the railroads is twice as large as it was a few years ago, and a large number of men is employed by the various contractors. While forces have been cut at some of the older mines, the increased forces of the new mines has more than made up for the difference. There will be no wage reduction for some time to come, but such action will be inevitable if Lake copper continues to sell for 11 to 12 cents.

An increase of nearly 15 per cent in Lake Superior copper production in 1902 may occasion surprise in some quarters, while in others it will raise doubts. For the past six years, previous to 1902, the lake output remained practically stationary. During the latter part of that period a vast amount of new work was being done, but owing to local conditions it had no effect on production until last year. One of the greatest successes of the last half decade is the opening of the South Range group of mines, the Baltic, Trimountain and Champion. From results already obtained it is evident that a large part of the lake output in future years will come from these mines. The year 1902 marked the ascendancy of the South Range mines, and from a production of 14,250,000 pounds last year the output will grow to more than 30,000,000 pounds in 1903, an increase of more than 100 per cent.

It is a difficult matter to determine the value of the production for 1902. Most of the Lake mines sell direct to consumers, sometimes under the market price and sometimes at a slight advance. Moreover, some of the mines contract a certain amount of their output at a stated rate, and in the meantime the current selling price of copper may have declined or increased. Estimating the market value of the 1902 production at the current selling prices for the year, the Lake output last year was worth \$19,500,000. The dividends from this production amounted to 12 per cent of the gross value. To date the Lake mines have produced 3,002,679,867 pounds of ingot copper, the gross value of which was \$461,117,304.

The dividend disbursements of Lake Superior copper mining companies, to the close of 1902, have been as follows:

Atlantic	\$940,000
Calumet & Hecla	79,850,000
Central	1,970,000
Cliff	2,518,620
Copper Falls	100,000
Franklin	1,240,000
Minnesota	1,820,000
National	320,000
Oscela	4,407,000
Pewabic	1,000,000
Phoenix	20,000
Quincy	13,570,000
Ridge	100,000
Tamarack	8,490,000
Wolverine	990,000
Total	\$117,335,620

That this is a good showing, and one equaled by few mining districts in the world, no one will dispute. The Calumet & Hecla has furnished 68 per cent, the Quincy 11 per cent and the Tama-

rack 7 per cent of the total profits distributed among shareholders of Lake mines. Of the total profits disbursed by the mines of the district, these three mines have furnished about 86 per cent.

In 1902 the total dividend disbursements of Lake Superior copper mines was \$3,440,000, compared with \$7,496,000 during the previous year. In explanation of the decrease in dividends for 1902 from the figures of the preceding year it may be stated that the decline in the price of copper was the sole cause. The profits in 1902 were much larger than the amounts distributed among the stockholders, but the surplus funds were largely added to, notably in the case of the Calumet & Hecla. By adding to their surplus funds the Lake mines have strengthened themselves financially, and are now prepared to face even a lower-priced metal market.

At the close of 1901 the leading mines of the district had about 25,000 stockholders, according to reports filed with the secretary of this State last August and September, as required by law. This is an increase of about 5,000 shareholders in one year, and surely indicates that there is a growing interest in the Lake Superior copper mines.

PROGRESS OF MINING IN MONTANA FOR 1902

By WALTER HARVEY WEED.

During the year 1902 there has been a somewhat increased activity in the development of the mining resources of the State. This has been felt primarily in the development of gold deposits as a result of the success of investments in the Judith District of Fergus County, and of individual properties in other parts of the State. The silver mines have felt the low price of that metal and development has been correspondingly retarded, though the demand for silver-lead ores by the smelters has kept many producing properties in operation.

The development of electric power for mining purposes has continued, and Butte is now supplied from dams on the Missouri, 72 miles away, on the Madison River, and the Big Hole River. The first named also supplies power to the East Helena Smelter, and to various mining and industrial plants.

The extension of the Twin Bridges branch of the Northern Pacific Railroad has given new life to the mining camps of the Tobacco Root Mountains and Virginia City.

Copper.—The copper situation remains practically unchanged. The numerous suits at law between the Amalgamated Copper Company and the Heinze interests are still before the courts, no case having yet received final adjudication. As a result of these suits production has been entirely shut off from some properties, and greatly curtailed in others. The New Washoe Smelter at Anaconda, which went into commission shortly after the first of the year, is now running satisfactorily and handling 4,500 tons of ore a day, a business estimated at \$60,000 a day. The old works of the Anaconda Company are idle, save the electrolytic refinery, which is refining the output of the New Washoe Smelter.

The Great Falls plant, which was completely overhauled during the latter part of 1901, started up again in January, running uninterruptedly since. The Butte & Boston Smelter at Butte can show a prosperous year, and while not considered as thoroughly modern as the larger plants of the Amalgamated Company, it probably can show as good, if not a better economic record for the year. The matt produced by the Colorado Smelter and the Butte Reduction Works (the latter owned by Senator Clark) is being converted at the New Washoe. In August a fire destroyed the reverberatory department of the Butte Reduction Works. This was rebuilt and again in operation by October. The fire did not necessitate the closing of the other departments

of the works. The Montana Ore Purchasing Company smelter has continued in operation without ceasing, although a fire on August 28 completely destroyed the company's concentrator, which was the means of curtailing the output of the smelter itself. The concentrator was not rebuilt, but instead the management leased the uncompleted concentrator at Basin owned by the Basin & Bay State Mining Company. This plant has been put in working order, the Montana Ore Purchasing Company sending its crude ore to Basin and returning the concentrates to the smelter at Butte to be treated. During the year Mr. Heinze merged the Montana Ore Purchasing Company and auxiliary companies into the United Copper Company.

Early in the summer the Speculator Mine was closed by a court injunction, and has since remained idle. The Minnie Healey Mine, which was being operated by Heinze, was also closed by an injunction. The Pittsburg & Montana Copper Company, which succeeded the Farrel Copper Company, has prosecuted development work by sinking two shafts to bedrock on the flat east of Meaderville. The completion of this work has been attended by unlooked-for difficulties. The depth to solid formation was found to be in the neighborhood of 700 feet, a goodly portion of the sinking being through quicksand.

Outside of Butte the copper properties of the State have not yet reached the productive stage. The Indian Queen, near Dillon, has shown large bodies of glance and chalcopyrite, but is not yet a regular producer. The Basin Creek properties, in Jefferson County, have been worked throughout the year, and development work has been carried on in the copper properties near Helmsville. The Sweet Grass Hills and Blackfoot Reserve properties are as yet in the prospect stage.

Gold.—There has been a gratifying development of the gold deposits of the State, particularly in Fergus County, where several large cyanide mills are now in operation or in process of erection. The Kendall property in the North Moccasin Mountains is now treating 350 tons a day. The Barnes-King Mill, a near neighbor of the last, was enlarged, and is now treating 240 tons. Several plants of lesser capacity are also being operated with success. The successful treatment of the gold ores of this district by cyanide is an important feature of mining in Montana.

Near Helena the Winscott Mine, a steady but small producer for many years past, is now the property of the Big Indian Gold Mining Company, and possesses a 60-stamp mill, which started to drop its stamps in October last, operating by electric power from the Canyon Ferry dam on the Missouri River.

The Columbia Gold Mining Company at York, in Lewis & Clarke County, lost its stamp mill and cyanide plant by fire during the summer, and the mill has not yet been rebuilt.

The Marysville District is still productive, the Bald Butte Mine continuing to yield a steady output of high-grade gold ore. The Drumlummon Mine is practically worked out, and on the exhaustion of the old stope-fillings now treated, will, it is feared, be permanently abandoned. A 500-ton cyanide mill was placed in operation at Empire, treating the old tailings from the Empire Mine, and an attempt was also made to reopen this mine, but no new ore bodies discovered.

In the Phillipsburg District the Sunrise Gold property, which has been closed by legal entanglements, is again operating mine and mill, the full control having passed into the hands of Charles R. McClure, of St. Louis, Mo. The Granite Bi-Metallic Company has decided to double the capacity of their new 600-ton concentrator at once; the present mill was completed late in 1901. A new 50-drill Rix compressor has been installed, and electric haulage introduced in the mine, the power for this purpose and for the mill

being furnished by the newly completed electric power plant at Flint Creek Falls.

The Bear Gulch mines, near the Yellowstone Park boundary, have been tied up by litigation, now said to be settled, with a prospect of a re-opening and working of the property on a largely increased scale.

The Mayflower Mine, which has shown such a phenomenal gold output since its discovery in 1896, has been shut down, and is to be abandoned.

In the Rochester District the Watseca Mine has developed into one of the big mines of the State. The mine is now opened up to the 500-foot level, and a 125-ton concentrator will be added to the equipment at once.

The Cable Mine, near Anaconda, is being reopened by a Butte syndicate, which proposes to explore this famous producer thoroughly.

The Jeannette Mining Company, which took over the Boss Tweed-Clipper group of mines, near Pony, suddenly stopped work on the 100-stamp mill last spring, and its completion awaits the results of development work now being prosecuted by the company.

Prospecting for gold quartz veins has been unusually active in the western part of the State, where some fair fields of both gold and copper are reported. In the West Fisher District, Flat-head County, destructive snow-slides did considerable damage to several mills last winter, but this has been repaired, and two new mills placed in operation during the season.

Gold Dredging.—Six dredges have operated in the State during the season, three at Bannock, two near Virginia City and one on French Gulch, near Anaconda. Two of the Bannock dredges will be removed, having entirely exhausted the pay ground. The French Bar dredge, despite several mishaps, has been a commercial success, the average cost of handling the gravel being less than 5 cents a cubic yard, inclusive of interest on investment and all fixed charges. The two Bannock dredges were the pioneers in this work in the country, and have extracted over \$600,000 from an abandoned placer field. Near Virginia City the boats operating on the old Alder Gulch placers have cost the company nearly \$500,000 up to date, but are now operating so successfully that other boats will, it is said, be built.

Silver.—There has been little change among the silver camps of the State. At Neihart the gold values of the Florence Mine have kept this property in operation, and the demand for galena ores by the smelters has enabled other properties to keep open. The only new properties developed have been near Saltese in the Bitter Root Range, in an eastern extension of the Coeur d'Alene District. The Elkhorn property, but lately reopened, has shut down, and the Butte silver mines are only worked by leasers who supply the demand for silica-ores for lining the converters of the copper smelters.

Iron.—There has been an energetic search for desirable iron properties throughout the State, in part for a flux for the smelters, and to supply the projected iron furnace which President Hill, of the Great Northern Railroad, has promised to erect at Great Falls. Several properties in the Little Belt Range have been acquired or are under option, and a manganese deposit in the Sweet Grass Hills purchased for this purpose. Near Elkhorn the iron mine on the summit of Elkhorn Peak is operated by the owners of the East Helena smelter.

Coal.—The Chestnut coal mines have been sold by the Union Pacific Railroad to the Northern Pacific, and are being extensively developed. The Bear Creek field, near Red Lodge, Carbon County, is also being developed, and an extension of the railroad up Clark's Fork to these mines, is now assured. The Gallatin Basin coal-field has been actively developed during the year, but is still too remote from a railway to become a producer.

Oil.—Montana, like most States, has had its

oil excitement during the year, and various local companies are operating in the State. The Butte Oil Company, operating at Kintla Lake, near the Canadian boundary, has encountered oil in its well, but not in paying quantity, and the many other companies owning ground in the Flathead District are awaiting the results of this initial work. In Carbon County, where Mr. Thomas Cruse has sunk several wells in the past three years, a new attempt will be made to find flowing wells. No oil has yet been found in the Dillon properties.

THE PRODUCTION OF GOLD AND SILVER IN THE WORLD DURING 1902.

BY JOSEPH STRUTHERS.

Gold.—The production of gold in the world during 1902 is given in detail in the following table—the statistics for the principal producing countries, the United States, Australia, Transvaal, Russia, Brazil, Canada, Mexico, Rhodesia and British India being

The quantity of gold produced in 1899 was the largest yearly output on record, amounting to 15,139,140 fine ounces, valued at \$312,911,383.

From 1893 to 1899 inclusive, the three principal gold producing countries were the United States, Australasia and the South African Republic. During this period they contributed from 65 per cent of the total output in the first year to 74 per cent in 1899. In 1900 the Boer war caused the output of the South African Republic to drop to the comparatively insignificant figures of 348,760 fine ounces, valued at \$7,208,869 having been produced; in 1901 a further decrease was made to 238,991 fine ounces, valued at \$4,939,944, and, although in 1902 the production will very closely approximate 1,703,500 fine ounces valued at \$35,211,345. In 1902 the United States and Australasia together produced 59 per cent of the total output of gold in the world. The production of gold in Russia during the past 25 years has varied from the lowest output recorded, of \$18,500,000 in 1883, to the highest, \$30,500,000 in 1895, the average yearly

THE PRODUCTION OF GOLD IN THE WORLD DURING 1900, 1901 AND 1902.

Countries.	1900.			1901.			1902.		
	Fine Ounces.	Kilo-grams.	Value.	Fine Ounces.	Kilo-grams.	Value.	Fine Ounces.	Kilo-grams.	Value.
AMERICA, NORTH:									
United States....	3,781,310	117,604.6	\$78,159,677	3,805,839	118,363.9	\$78,666,700	4,243,357	131,951.0	\$87,710,189
Canada.....	1,350,176	41,992.4	27,908,153	1,183,465	36,807.4	24,462,222	943,391	29,342.5	19,500,000
Newfoundland....	2,400	74.6	49,608	2,110	65.6	43,613	2,110	65.6	43,613
Mexico (a).....	455,204	14,158.3	9,409,063	499,725	15,554.2	10,329,316	482,244	14,998.5	9,067,979
Can. America....	38,703	1,203.7	800,000	49,831	1,549.8	1,030,000	48,379	1,504.7	1,000,000
AMERICA, SOUTH:									
Argentina.....	2,112	65.7	43,655	2,112	65.7	43,655	2,177	67.7	45,000
Bolivia.....	7,256	225.6	115,000	8,466	263.3	175,000	8,466	263.3	175,000
Brazil.....	127,820	3,975.4	2,642,060	145,138	4,514.0	3,000,000	130,624	4,062.6	2,700,000
Chili (b).....	43,541	1,354.2	2,900,000	21,771	677.1	1,450,000	24,190	752.3	500,000
Colombia.....	111,272	3,460.7	2,300,000	100,145	3,114.7	2,070,000	101,597	3,159.8	2,100,000
Ecuador.....	9,676	300.9	200,000	12,700	394.9	262,500	14,514	451.4	300,000
Buiana (Br.)....	110,640	3,441.9	2,286,918	92,032	2,862.3	1,902,301	85,000	2,643.8	1,757,000
Guiana (D.)....	27,082	842.3	559,793	28,938	890.0	598,140	30,237	940.4	625,000
Guiana (Fr.)....	68,353	2,126.0	1,412,857	115,576	3,594.6	2,388,958	115,744	3,600.0	2,392,560
Peru.....	58,357	1,815.0	1,206,249	80,369	2,499.6	1,661,234	87,083	2,708.4	1,800,000
Uruguay.....	2,283	71.0	47,187	2,411	75.0	49,845	2,419	75.2	50,000
Venezuela.....	49,194	1,530.0	1,016,838	49,194	1,530.0	1,016,838	55,036	1,730.4	1,500,000
EUROPE:									
Austria.....	2,279	70.9	47,120	2,279	70.9	47,120	2,279	70.9	47,120
Hungary.....	105,143	3,270.1	2,173,308	105,143	3,270.1	2,173,308	105,143	3,270.1	2,173,308
France.....	6,527	203.0	134,914	6,527	203.0	134,914	6,527	203.0	134,914
Germany (d)....	3,601	112.0	74,435	2,894	9.0	59,814	2,894	9.0	59,814
Italy.....	1,849	57.5	38,215	132	4.1	2,725	132	4.1	2,725
Norway.....	87	2.7	1,794	87	2.7	1,794	86,812	2,700.0	1,794,420
Portugal.....	84	2.6	1,728	84	2.6	1,728	84	2.6	1,728
Russia.....	1,072,434	33,354.2	22,167,201	1,253,592	38,988.5	25,911,744	1,450,000	45,068.6	29,971,500
Spain.....	377	11.7	7,800	370	11.2	7,648	370	11.2	7,648
Sweden.....	3,414	106.2	70,580	2,845	88.5	58,817	2,845	88.5	58,817
Turkey.....	375	11.6	7,751	643	20.0	13,292	643	20.0	13,292
U. Kingdom....	12,760	396.8	263,749	9,664	300.6	199,754	9,664	300.6	199,754
AFRICA:									
Transvaal.....	348,760	10,846.9	7,208,869	238,991	7,432.9	4,939,944	1,703,500	52,981.3	35,211,345
Abyssinia.....	33,865	1,053.3	700,000	33,865	1,053.3	700,000	33,865	1,053.3	700,000
Rhodesia.....	79,354	2,468.0	1,640,251	148,753	4,626.4	3,074,730	164,000	5,100.9	3,390,000
Soudan.....	2,701	84.0	55,826	2,701	84.0	55,826	2,701	84.0	55,826
West Coast....	36,284	1,128.5	2,750,000	30,000	933.0	620,100	25,000	777.6	516,750
Madagascar....	33,471	1,041.0	691,849	36,284	1,128.5	2,750,000	36,284	1,128.5	2,750,000
Mozambique....	8,475	263.6	1,750,000	12,377	384.9	255,840	14,514	451.4	300,000
ASIA:									
Borneo (Br.)....	19,873	616.9	410,038	21,771	677.1	1,450,000	24,190	752.3	500,000
China.....	208,031	6,470.1	4,300,000	145,138	4,514.0	3,000,000	160,755	5,000.0	3,323,000
E. Indies (D.)..	26,609	827.5	550,000	43,541	1,354.2	2,900,000	48,379	1,504.7	3,000,000
India (Br.)....	512,710	15,946.0	10,597,712	458,870	14,178.2	9,422,855	460,000	14,397.5	9,508,000
Japan.....	68,485	2,130.0	1,415,598	73,952	2,300.0	1,528,580	77,407	2,407.4	1,600,000
Korea.....	87,882	2,733.3	1,816,525	111,272	3,460.7	2,300,000	111,272	3,460.7	2,300,000
Malay Peninsula	17,048	530.2	352,382	18,000	559.8	372,000	18,000	559.8	372,000
Australia (f)...	3,586,279	110,978.5	73,756,325	3,728,057	115,947.8	77,058,938	3,934,000	122,360.1	81,315,100
Unspecified (g)...			21,771	677.1		450,000	24,190	752.3	500,000
Totals.....	12,527,907	389,658.8	\$258,951,204	12,706,533	395,220.5	\$262,641,853	14,882,618	462,829.0	\$306,723,462

(a) Figures based on exports of ores, matte, etc., and coinage. (b) Computed from exports. (c) As reported by the *Statistique de l'Industrie Minérale*. (d) Production from domestic ores. (e) Estimated. (f) Includes six States and New Zealand. (g) Includes Serbia, Persia, West Indies, Formosa, British New Guinea and Philippine Islands. NOTE—The value of gold is \$20.67 per ounce, which is equivalent to \$664.60 per kilogram.

based upon reported returns for ten or eleven months of the year, supplemented by cable reports for December where essential. These countries produced practically eight-tenths of the total output of gold in the world during 1901 and the figures for 1902 will therefore closely approximate the revised totals which will be published in the *ENGINEERING AND MINING JOURNAL* and *The Mineral Industry* later in the year when official returns have been received. The detailed statistics of the world's production for the years 1900 and 1901 are also given in order that the year's progress in each country may be compared with the development during the two years immediately preceding.

There was an increase in the quantity of gold produced in the world during 1902 over that of the preceding year, the respective statistic being 14,882,618 fine ounces, valued at \$306,723,462, as compared with 12,812,792 fine ounces valued at \$264,840,477 in 1901.

output being about \$25,000,000.

Silver.—The production of silver in the world during 1902 amounted to 184,213,892 troy ounces, valued at \$100,795,653, as compared with 170,565,304 ounces valued at \$100,795,653 in 1901. The chief producers of silver in the world are the United States and Mexico, which together furnish 60 per cent of the entire world's output. During 1902, the production of silver in the United States was practically 67,152,958 ounces, of a commercial value of 35,067,275 (the average price of silver at New York during 1902 was 52.51 cents per ounce as compared with 58.95 cents per ounce in 1901). The production of silver in Mexico for the fiscal year ending August 30, 1902, was 56,863,223 ounces, valued commercially at \$29,693,975, and for all purposes of comparison this production during the fiscal year, may be taken as equal to that of the calendar year. For the remaining countries which collectively produced 32.5 per cent of the

world's entire output of silver, it has not been practicable to obtain official reports of the production on which to base an estimate; the statistics for these countries which have been used to arrive at the grand total of the production of silver in the world, have been repeated from the preceding year. While there will be a few changes in some of these reports, it is not probable that the change in totals will be sufficient to impair the value now given for purposes of comparison.

A most noteworthy feature of the silver industry during the year has been the phenomenal drop in value. The price during the year averaged but 52.15 cents per ounce at New York, in 1875 the average price per ounce was more than \$1.20, from that time it has declined gradually to 58.26 in 1898, in 1899 it was 59.58, in 1900 it was 61.33, and in 1901 it was 58.95. The detailed prices will be found elsewhere in this section under market reviews.

Detailed reviews of the progress in the principal gold and silver mining districts will be found elsewhere in this section.

CALIFORNIA MINES IN 1902.

By Our Special Correspondent.

No specially marked change in the conditions of mining in California are to be noted for 1902, nor is it probable that completed statistics will show any material difference in output for the previous year. Naturally, however, some localities have shown distinct advance and many improvements have been made which will have their effect in future operations. It is to be noted that in recent years more capital has been invested in mining operations in California, and that much of it has come from communities east of the Sierra Nevada Mountains. The result of this has been that mining affairs are conducted on a larger scale than formerly, and that extensive plants have been designed and constructed. Some considerable capital has been invested in branches of the mineral industry heretofore neglected by the Californians themselves, with the result that now some 49 mineral substances are commercially utilized, adding greatly to the total value of the annual mineral product of the State.

As gold has, since the discovery, been the leading output of the State in the way of mining, so it still continues. From 1848 to 1901, inclusive, the total product of gold in California has been \$1,362,365,088. The average gold yield per annum for the past few years has been between \$15,000,000 and \$17,000,000. This is now gradually increasing as old mines are reopened and equipped, and new ones are developed. Some new sources, notably dredging fields, and the gold obtained in large copper-smelting operations, are materially aiding in the increase. In the case of the dredgers, ground formerly idle and thought useless, is being utilized profitably; and in the copper smelting hundreds of small mines now furnish gold-bearing quartz for flux, many of which mines would hardly pay for working unless the ores could be readily disposed of to be mixed with other ores.

Probably the most noteworthy matter in connection with gold mining operations is the utilization of electric power, water power and oil for fuel, thus materially cheapening, hoisting, pumping, milling, etc. By these means ores formerly of too low a grade to pay a profit are now being extensively mined. The larger introduction of the cyanide process has also been a factor in this connection. Many old dumps and beds of tailings are being worked, as well as pulp direct from mill and concentrators.

Another feature of the past two years is the increase of milling facilities at established mines. Where formerly 10 or 20 stamps were run, 40 or 50 are now considered essential. All over the State this desire for increasing milling capacity is apparent. At new mines, where they start with 20 stamps, they prepare foundations for doubling

the number when necessary. A great many 10-stamp mills have been enlarged to 20 during the past year, and a few larger ones have been increased to 100. This naturally results in developing more mines, in making greater developments and an increased output.

The electric power plants in the mining counties are now furnishing power for the more important camps, and for smaller places along their lines. Several new ones have been built during the past year, and others are being constructed. There are hundreds of fine streams in the high Sierras, which run down to the foothill regions, where abundant water and fall may be secured, and but few of them have thus far been utilized. As the demand arises, however, power plants are being put in. As to petroleum fuel in place of wood in the mining regions, its use has largely increased where the camps are within reasonable distances of railroad lines. Many of these camps have been long established, and all the wood nearby has been used up, necessitating haulage for some distance and at increased cost. The oil fuel has been found, therefore, considerably cheaper. This cheap power, electric, water or oil fuel, has been an important factor in mining development in the State in the past few years.

Lack of space prevents giving consideration to the condition, and prospects of individual mining properties or districts in California, but the notes in the general mining news from these in each weekly issue of this paper during the past year have covered these points. It may be said, however, that there is a general advance in the progress of the mining industry in most of the counties of the State. New mines are being opened and developed, and are being equipped with suitable reduction plants. A number of old mines have been reopened, unwatered and again brought to a producing stage. Most of these were abandoned years ago as unprofitable, but the changed conditions of the present day, when ores of much lower grade may be worked than formerly, make it possible to now operate them successfully. In fact, quite a proportion of the largest producers of the present time are mines that were abandoned for some years and subsequently reopened.

The Statistician of the United States Mint, in San Francisco, placed the gold output of California at \$16,989,044, and the silver at \$1,229,356 for the year 1901—the latest available complete statistics. This showed an increase of upwards of \$800,000 above the previous year's record. Of this output, \$12,499,743 was derived from quartz mines, \$3,951,049 from placers (including surface, hydraulic and drift), \$116,867 from lead ores and \$421,385 from gold obtained in copper smelting operations.

Including both gold and silver, \$14,264,369 came from quartz mines (including lead and copper operations), \$1,191,800 from surface placers (including river, mining, dredging, ground sluicing, etc.). The drift gravel mines yielded \$1,062,450, and the hydraulic mines \$1,609,781. Included in the placer figures is \$471,762 obtained in dredging operations. These figures show briefly about the average now being derived annually from the different kinds of gold and silver mining being carried on in California. Not only is the amount from quartz and copper mining being increased, but the dredging fields are being exploited much more extensively than ever before, and quite a number of new dredgers are now being built to open hitherto untouched placer ground.

In hydraulic mining there is not much apparent increase in the older central mining counties, once the seat of very extensive operations of this character. The restrictions of the law are such as to discourage large investments in this class of gravel mining in those counties. All debris must be impounded behind works built and maintained by the companies, entailing extra expense and restricting the amount of gravel capable of being worked. In the northwestern counties of Trinity, Siskiyou, Humboldt, etc., there

are no navigable rivers to be injured, and no such restrictions, and in that part of the State hydraulic mining is on the increase.

There are now in California 35 counties in which gold is produced, and 26 from which silver is obtained. The leading counties in the order of their productive rank are Nevada, Calaveras, Amador, Shasta, Tuolumne and Kern, each of which produced over \$1,000,000 in 1901, while the first two named yielded over \$2,000,000 each. The largest silver producers are Shasta, San Bernardino and Inyo counties. The greatest producing county in the State, all substances being considered, is Shasta, with a total yield in 1901 of \$6,737,571, including gold, silver and copper. The copper alone was worth \$4,881,048.

The following table, compiled by the State Mining Bureau, gives the total amount and value of all mineral substances produced in California for the past fifteen years, or from 1887 to 1901, inclusive:

Leading Products.	Total for 15 years.	
	Quantity.	Value.
Antimony	680 tons	\$79,805
Asbestos	582 tons	27,800
Asphalt	189,593 tons	2,920,964
Bituminous rock	563,538 tons	2,044,173
Borax	247,072,000 lbs.	10,458,649
Cement	295,683 bbls.	789,248
Chrome	22,766 tons	304,750
Clay—brick	932,824 M.	6,111,005
Clay—pottery	867,352 tons	674,279
Coal	1,557,582 tons	4,069,548
Copper	136,464,683 lbs.	19,788,337
Fuller's earth	2,120 tons	35,650
Gold .....	.....	213,990,369
Granite .....	..... cu. ft.	7,513,372
Graphite	64 tons	4,480
Gypsum	41,004 tons	361,096
Infusorial earth	143 tons	5,575
Iron ore	450 tons	3,500
Lead	7,266 tons	552,467
Lime and limestone .....	.....	5,210,070
Lithia mica	1,664 tons	43,100
Macadam	4,186,435 tons	3,336,125
Magnesite	22,867 tons	228,786
Manganese	7,730 tons	69,646
Marble .....	..... cu. ft.	671,282
Mineral paint	6,221 tons	100,035
Mineral water	14,047,814 gals.	3,835,480
Natural gas .....	..... cu. ft.	870,402
Onyx and travertine .....	.....	91,400
Paving blocks	17,052 M.	444,524
Petroleum	25,323,307 bbls.	22,375,808
Platinum	3,307 ozs.	18,501
Pyrites	19,620 tons	98,182
Quartz crystals	8,000 lbs.	55,500
Quicksilver	434,977 flasks	17,018,249
Rubble	3,344,941 tons	3,124,771
Salt	860,080 tons	2,225,576
Sand—glass	8,500 tons	19,750
Sand—quartz	1,700 tons	2,200
Sandstone .....	..... cu. ft.	1,574,381
Serpentine	9,689 cu. ft.	20,390
Silver .....	.....	12,531,466
Slate	32,860 squares	207,739
Soapstone	435 tons	18,244
Soda	37,430 tons	1,096,500
Sulphur	2 tons	50
Tin	287,289 lbs.	59,964
Tourmaline .....	..... lbs.	20,500
Turquoise	1,000 lbs.	40,000
Totals .....	.....	\$346,023,688

Taking into consideration all the mineral products, precious metals included, California is showing steady progress from year to year, with quite a satisfactory regular increase in value. For the past ten years the annual record of mineral output has been as follows:

1892	\$18,300,168
1893	18,811,261
1894	20,203,294
1895	22,844,663
1896	24,291,398
1897	25,142,441
1898	27,289,079
1899	29,313,460
1900	32,622,945
1901	34,355,981

These are the official figures of the State Mineralogist of California. They may be a surprise to some persons who have considered the mining industry in California in a state of decadence. Since 1848 California led all other States in production of gold, until a few years since when the camp of Cripple Creek gave Colorado the lead and put California in second place as to gold output. This fact, and the partial suppression of hydraulic some years ago, led many to believe that California as a gold mining State had seen its best days.

But the laws now permit hydraulic mining, under certain restrictions in certain districts, while in all other districts it has never ceased at all.

Meantime, there has been a distinct revival in quartz mining throughout all the counties. More capital has been invested, and hundreds of old mines reopened and new ones started up and equipped. Copper smelting operations demanding quartz for flux have caused many small properties to be worked. The dredges have opened new gold-fields previously considered worthless, and generally the gold industry is in a prosperous condition.

Meantime the other mineral industries of the State have come to the front. There has been a decided revival in quicksilver mining, and many mines have lately been brought to a producing stage. The copper interests are far larger than ever before, and more productive. The discovery of extensive oil fields in counties hitherto unproductive, has brought that branch of the industry into prominence. Overproduction for a time reduced prices so that many productive wells were closed, but this is fast remedying itself, and the petroleum miners are now more prosperous. The borax fields are being more freely exploited than previously. There is a large increase in the output of soda. The quarrying industries are widening in scope and value.

Altogether it may be stated that the general mining industry of California is in a prosperous condition, and being advanced in many directions.

COLORADO IN 1902.

Owing to the further fall in the price of silver and the exhaustion of several of the larger gold mines of the State without a commensurate development of new districts, the mining industry of Colorado at the end of 1902 presents a less hopeful condition than is usual. The main producing regions of Cripple Creek, Leadville, Gilpin and lower Clear Creek are becoming slowly exhausted of the ore-bodies previously opened up and unless unexpected new finds are made their production is likely to diminish. Leadville is now practically a smelter annex, the bulk of the tonnage being in the form of fluxing iron ores, which render the district very dependent upon the rates allowed by the smelter consolidation. At Cripple Creek several of the larger bonanza mines have drawn on the cream of the big ore-bodies until only the skimmed milk of low-grade ore remains. The recent development in the lower workings of the Wild Horse, Last Dollar and other young mines is, however, of better augury for the future. There is also a promise of betterment in mining conditions through the projection of a drainage adit which will permit of deeper development on the part of several important properties now handicapped by heavy pumping costs.

On the whole, it can be said that the best outlook is in upper Clear Creek, and in the San Juan region, especially near Silverton. In these localities new enterprises have been started, many of which are based on valuable ore-bodies, so that young mines will help to redress the balance of the old exhausted properties. This renewal of activity is largely traceable to improvements in concentration and other metallurgical processes which have invited the resuscitation of abandoned mines.

The purchase of the Camp Bird Mine by English capitalists at a price of \$3,500,000, and the very profitable operations started by the new company, forms one of the most pleasing incidents of the year. To this may be added the completion of the new Tomboy mill at Telluride, which has been built in consequence of the successful outcome of explorations on the Argentine lode in Savage Basin. One of the inevitable results of changing conditions is shown in the closing of the large Philadelphia Smelter at Pueblo; this was due in part to a diminution of Colorado ores and was partly the result of the cessation of shipments of Utah ores, diverted to the new smelting plant at Murray, near Salt Lake City, recently erected by the smelter consolidation. The

labor troubles at Telluride, culminating in a sensational murder, have most unhappily drawn attention once more to local misgovernment, the repetition of which it is believed the new governor will do his utmost to prevent. The attention directed to the utilization of low-grade silver-bearing zinc ores promises to be an important factor in the future of the State, as has been recognized not only by the two small plants which have started to work on the outskirts of Denver, but mainly in the building, by the American Smelting and Refining Company, of a zinc works at Pueblo, to be ready in April. This is of small capacity, but if successful will be followed by the erection of similar plants elsewhere, so as to act as feeders to the central smelters controlled by the smelter consolidation.

This company controls the well-being of the mining industry to an extraordinary and, perhaps, unfortunate degree. The gradual consolidation of all the large plants and the inevitable obliteration of the small ones has placed into the hands of the consolidation a great power, because it has become the sole market for low-grade silver-lead ores and pyritic concentrates. It is hoped that the able men who direct its operations will recognize the mutual interests of producer and buyer, and will endeavor by just dealing to stimulate the mining industry of a State which has always owed much of its prosperity to the possession of centralized smelting establishments.

Colorado is a region of the unexpected, and it covers a tract of mountain country so extensive and rich in varied minerals that the recovery of the State to its former condition of great prosperity is always a hopeful possibility.

THE LEADVILLE DISTRICT IN 1902.

By J. O. HEIMBERGER.

The work of the past year has been fraught with good results, and while the valuation of the year's production is not as heavy as the year previous, this fact is due to the depreciation in the value of the white metal. The tonnage figures show an immense product. The smelters, mills and mints show in total a production of \$9,468,544 during 1902 for the Leadville District, divided as follows: Gold, \$1,302,680; silver, \$3,051,195; lead, \$1,694,410; copper, \$303,409; spelter, \$3,103,448; manganese, \$8,400. The oxidized iron tonnage was 285,494 tons; sulphides, 281,558 tons; zinc ore, 85,699 tons; siliceous, 72,215 tons; carbonate, 22,730 tons, and the remainder manganese and other material.

The advance made in the line of new work and the operations carried on in new territory present a substantial array of facts in the line of progress that cannot afford to be overlooked. The discovery made in the Yak Tunnel at a point some 1,300 feet from the surface on Breece Hill, showing a sedimentary mineralized formation, and for the first time proving the presence of a deposition at this great depth, means much for that part of the gold belt—a permanency heretofore predicted, but never before a known quantity. Then there has been the rejuvenation of the Fryer Hill locality through the drainage of the El Paso shaft, and further progress has been made on this hill by the recent discovery of an extension of the old-time bonanza shoots on North Fryer Hill for the first time opened up in virgin ground. The successful operation of the new A. Y. & Minnie mill, as well as the A. M. W. and other mills erected before, has done much toward assisting in handling the low-grade zinc and lead sulphide ores, and has virtually been the means of successfully launching the milling era, for the Resurrection is just completing a big mill, while several other mills are projected for 1903. The fact that the American Smelting and Refining Company has spent several hundred thousand dollars recently in new roasters for handling low-grade ores, and that the Boston Gold-Copper Smelting Company's pyritic plant has just been purchased for the purpose of being enlarged to handle the low-grade materials gives much encouragement for the future of the low-grade problem in the Leadville District, which problem has been a

serious one for the mine manager and the mine owners for the past year. A general renewal of operations in many of the outlying localities among old-time producers that have been idle for years; and a search in virgin territory lying to the west of the city for the extension of the ore shoots found and successfully operated above, are all features of the year's work that must necessarily rebound to the good of the district, and are partially an off-set to the depressed silver situation.

There has been a material improvement in the zinc situation during the year, and a steady market has been secured from foreign shores as well in Kansas and Colorado. The United States Zinc Company at its Canon City plant is handling a heavy dump tonnage of zinciferous material, the principal producer being the Moyer Mine of the Iron Silver Company. With the completion of the new zinc smelter at Pueblo a material increase in tonnage will again be made. There has been much talk during the year of independent smelters, but outside of the Salida plant erected by the Ohio & Colorado Smelting Company, which is now in successful operation, no smelters have materialized. However, on the other hand, the smelter combination has expended a large sum of money in several of its State plants, but more particularly at Leadville, and announce the determination to still enlarge and prepare for additional tonnage of low-grade ores.

The greatest step forward in the work of the year has been made in a locality that for years has been practically worked only on a small scale, and that has been water-soaked for ten years past. This is the Fryer Hill country, lying just to the east and north of the city limits. After some months of sinking the Progressive Mining and Development Company recently caught in its O. K. shaft on North Fryer Hill the extension of the old bonanza ore shoots, and development work in progress there now indicates a permanency which will mean much for that part of Fryer Hill. In fact, the Esteyes on the Price shaft, J. J. O'Neill and others on adjoining territory, and a new shaft by the Fryer Hill Mines Company are three shafts all being sunk as fast as possible to tap this same ore shoot while the large acreage of virgin territory adjoining will be next in line for development. One of the greatest accomplishments of the year on Fryer Hill and, in fact, in the camp, was the successful draining of the immense acreage owned and controlled by the Fryer Hill Mines Company, headed by Messrs. Newell and Page, and which territory was drained through the El Paso shaft. The drainage work occupied five months, and was done at a cost, including machinery, of \$55,000, while an additional \$15,000 has placed the workings in condition for successful opening and ore shipments are steadily being increased. There are great bodies of low-grade ores standing in the old workings, which can be successfully handled while the new work under way has already shown some rich deposits, and with the immense acreage of virgin territory open for development work from now on, the Fryer Hill country will soon be prominent as a leading producing section, both in high and low-grade material.

Sloping from this locality to the west into the city limits and extending under much of the residence part of the town are ore-shoots that have already produced some millions of dollars, and which have been quite actively developed during the past year, although in a monetary way this Leadville Basin has not made the production of the year before. At the present time, however, there is new work under way which promises very good results. The Valentine property, one of the new downtown propositions that laid idle all year, is just resuming operations, while the prospecting work done with the diamond drill and a 300-foot shaft on the Homer placer, was so satisfactory that this property is to resume in the early spring, and will prospect 150 acres of virgin ground, while to the north of this territory the Sharpe Mining Company has just inaugurated work with a series of new shafts to open virgin

ground. The Home Mining Company did not have much success in a money-making way during the year, and while they mined and opened up large iron bodies the material was so low grade that they ran behind, and recently money was raised to pay off their debts and to continue operations in untried ground of the combination in the hope of getting richer ore, of which there are excellent indications. In the Caribou, George Campion has opened up some fine iron bodies, and the material is improving, and will permit of heavy shipments from now on. At the Sixth Street and Coronado shafts large bodies of low-grade iron have been mined, and these deposits are very extensive in the former property, which will continue heavy shipments in addition to prospecting work. The Cloud City has large manganese deposits in sight, and is arranging to ship this material to Pueblo, and to use the proceeds for carrying on deeper exploration to open up the extension of the Leadville Basin shoots. This company has expended \$200,000 in securing mineral rights in the city limits on underground territory. A fact not to be overlooked is a probable resumption of both the California Gulch and Maple Street companies, now lying idle, in case the Valentine Company, just starting work, opens up an ore body. There will also be extensive placer working done on this territory in the extreme western part of the Leadville Basin.

Graham Park country and Carbonate Hill have given some very good results during the year. The consolidation of the A. M. W. properties with the A Y & Minnie and the Mahala controls an immense acreage, which, under the direction of Messrs. Nicholson and Rodman, with a heavy capitalization, permits of operating on a scale which promises success. In addition to much new development work and the opening up of large low-grade sulphide bodies, the combination has erected a new mill at the A Y & Minnie Mine, which is like the A. M. W. Mill, handling a heavy tonnage of the lower grade material, thus permitting of the mining of an ore that could not otherwise be handled. The Midas, controlled by this same combination, has also been a steady producer throughout the year, while its massive iron shoots seem to be inexhaustible and leave the lower contacts yet to be explored, although there is still great strength in the upper ore shoot, despite the fact that it has already produced some 200,000 tons of good grade ore. In this same locality the Arnold Leasing Company, the Toledo, the Carbonate Hill and a few other properties have carried on operations, but without any success. The Greenback, of course, has opened up its immense iron sulphide shoot on all parts of its territory, and in sinking its main shaft deeper has disclosed better iron than ever. However, owing to no agreement being reached with the smelter combination the Greenback has shipped no ore for months past, but once this tangle is straightened out the Greenback can ship 300 to 400 tons a day for a long time to come. At the Evelyn property where the shaft cut a sulphide shoot at 930 feet, the shaft has been sent deeper and they are now prospecting with good indications of opening a mine. The big Marian property of the Small Hopes combination has mined quite a sulphide tonnage and explored considerable new territory with satisfactory results, and once they get a market for this low-grade sulphide will be able to ship large quantities. In the meantime, the various shafts of the Small Hopes have been operated under lease, and some very good lead ore has been shipped while a large amount of development work has been carried on. The Stars, and a number of other old-time properties, are being worked in their upper levels by lessees, who make occasional shipments, and at the same time do a little development work in their territory.

Turning to the south and proceeding up California Gulch one finds considerable activity in a leasing way around the Yak Tunnel and on Iron and Rock Hills, while some of the best propositions of the district are located right in this neighborhood. None of these are more important than the Yak Tunnel, which has its heading in California Gulch, bores its

way through the silver-lead producing area, and is pushing through towards the Ibex territory at a rapid rate. The tunnel is in about 1,400 feet, and is going through the best part of the gold belt, now pushing to the Ibex lines on a contract entered into with those people to open up a part of their ground, so that in addition to proving a valuable drainage proposition for them it will also prospect the Ibex territory at a depth of 1,300 feet, a depth never before attempted, and which is looked upon as a most important step in the prospecting of that part of the gold belt. Recently at a depth of nearly 1,300 feet the tunnel also cut through a sedimentary formation, showing signs of mineralization and proving that there is another contact below that already explored which will eventually be prospected, and which for the present in its discovery goes to prove a permanence for Breece Hill country, many acres of which are yet to be prospected. But dropping back to Iron Hill, it is pleasing to note the activity about the old Iron-Silver Mining Company's territory. It has had a very active year, and in addition to shipping from the Moyer workings from 5,000 to 6,000 tons a month it has also made steady shipments from the old Moyer dump, which was sold to the United States Zinc Company. A large amount of work in virgin ground has been carried on with very good results, while a new shaft further down the hill to tap the old ore shoots is being sent down. The Moyer Mill has been handling the low-grade ores, making a steady production of good zinc concentrates. The Mike & Starr is successfully opening its copper sulphides through the Yak, while a tunnel drift being run from this tunnel will similarly open up the Ruby property and permit of large shipments of copper sulphides. The Naylor Company has opened up large sulphide bodies in the lower workings of the White Cap, while the resumption of operations on the old Louisville, Ulster-Newton and adjoining territory is most encouraging. A large amount of small lessee work, both here and about the Emmet, La Plata and other Rock Hill territory, indicates good results for that locality during the coming year. The A Y & Minnie properties in the combination spoken of above are planning very important new work while the mill completed a few months ago and one of the finest in the district is successfully treating a low-grade material, which could not otherwise be handled.

In addition to the help to the Ibex Company promised by the coming completion of the Yak Tunnel, that company has been by no means idle, and, as usual, in the Ibex shafts there has been much new work, and a number of miles have been added to the extent of workings during the past year, while from 5,000 to 8,000 tons of all classes of ore have been shipped every month. On the Resurrection there are great bodies of low-grade sulphides exposed, but shipments have been light, owing to slack market. The most important step here is the erection of a mill to handle a heavy tonnage by concentration. This mill is almost completed, and will greatly add to the product from the gold belt in the way of good concentrates from low-grade sulphides. Another consolidation that will make a better showing in 1903 than the past year is the New Monarch group, where great bodies of low and high-grade material have been opened up. This company recently began shipments again after a long idleness, shipping to the independent smelter at Salida, in which many of the Monarch owners are heavily interested. The company will be prepared to handle a heavy tonnage from its properties in the future. Recent strikes in the Forest City and Valley combinations on the gold belt have been very satisfactory, and promise good results if the ore-bodies develop as indicated. At the Diamond and President and Banker there has been much dead work done during the year past, and it is expected that 1903 will see some new shipping mines developed in this particular group. The Penn and the Ballard have large bodies of low-grade siliceous ore opened up, and the former has been shipping about 1,500 tons a month during the year. At the Ballard experiments have shown that cyaniding will successfully handle their ore, so the company is

just completing a new cyanide mill. If it proves successful in handling the low-grade material in quantities the mill will be enlarged, and it will mean a heavy tonnage of this material, as it abounds in large quantities in that part of the gold belt. An important piece of new work in the gold-bearing section is the starting up of the White Cloud combination by Mr. Kyle, backed by Eastern capitalists. This is virgin ground and well located. The following of a rich but small ore streak on the Vinnie; a similar condition on the Gold Basin and the Chippewa means that work on all these propositions will be pushed and will most likely result in more important discoveries.

In closing, the fact must not be overlooked that Eastern capital is stepping in at a much more lively rate than usual, and it is noticeable that in the outlying sections of the camp they are taking hold liberally. The resumption on the Rex by the Keystone Company, in Iowa Gulch; the work over in English Gulch and in Homestake are promising ventures, and will do much in opening up virgin ground where there are acres yet to be explored. The work in Two Bit Gulch and in old localities like the Sugar Loaf and St. Kelvin section, where properties are being successfully operated that have lain idle for years, shows a steady gain in the area of the mining district as well as a long permanency of Leadville as a mining camp.

UTAH MINES IN 1902 AND PROSPECTS FOR 1903.

By J. W. NEILL.

The mining camps of Utah are all situated within a radius of about 100 miles of Salt Lake City, so that most of the mining companies have their head offices in that city, and the mines may usually be visited in one day from headquarters.

The principal producing camps are Park City, Bingham, Tintic, Mercur and Gold Mountain.

Park City.—This camp is 30 miles east of Salt Lake City, and is reached by the Union Pacific and the Rio Grande Western railroads. It is the home of such well-known mines as the Ontario, Daly, Daly-West, Silver King, and its ores are almost entirely smelting ores, the values being carried in connection with galena and zinc-blende.

The shipping ore and concentrates from the principal mines will average about 35 per cent lead, 50 ounces silver and \$2 to \$3 per ton in gold. In this output there is usually 2 to 3 per cent copper, and also from 10 to 20 per cent zinc. These ores are sampled and sold to the American Smelting and Refining Company, on a schedule which usually permits the zinc contents to run up to 16 per cent without deductions.

In point of tonnage the Silver King and the Daly-West stand about equal; and both these mines are operated on the principle that for each ton extracted development shall open up an equal amount. There is no likelihood of any falling off in tonnage or values from these mines during the coming year, on the contrary, the Daly-West, since its absorption of the Quincy and therewith settlement of impending litigation, will no doubt ship even more heavily. At the Ontario matters are looking very prosperous, a good deal of shipping ore is coming out, a large force is working, and the late strike of good ore at a depth of 2,000 feet in the main shaft is a most favorable sign. This strike is not on the old Ontario vein, but in the limestone which underlies the Ontario quartzite, and is in close proximity to a porphyry dyke; this is the normal condition of all the large bedded deposits of the camp, and the find is therefore most important.

The combination of the Anchor with the Judge properties to form the Daly-Judge has added another to the list of the Park's large corporations. This company has a very large acreage, the old Anchor is well developed, the concentrating mill is well equipped, so that it has stepped into the ranks of large shippers and will increase its tonnage forthwith. There have been most promising developments in the Judge ground at great depth, so that the future of this mine promises a

large production. In the Daly Mine itself past work has been confined to the Daly fissure, and this had been largely exhausted down to the water-level of the lowest drain tunnel; lately prospecting has been undertaken for the Quincy vein, in the bedded formation, and this development also promises well. In the southern end of the camp, in Thaynes Canyon, the California has enlarged its mill, the Comstock is building a large mill, the Keystone, Apex, D. & M., and several others have started work on favorable locations, and everything promises increased production. Park City is attracting increased attention, several new companies are about to start vigorous exploratory work, so that it will be the liveliest district of the State in the spring.

The completion of the zinc works at the town will give an outlet for the zinc middlings from the mills, and it is likely that the zinc in the ores of the Park will more than compensate for the present drop in the price of silver. This new mill will handle the ores by the roast-magnetic separation process, and will ship high-grade blends to the Eastern refiners.

From the foregoing it is safe to predict that the output of the Park will increase during 1903 from 15 to 25 per cent.

Bingham.—The change in the character of the ore shipments from Bingham during the last few years has been a most interesting and remarkable one. Five years ago Bingham was strictly a low-grade lead-silver camp, dependent entirely on the lead smelters for a market, and chiefly on the finding of bodies of shipping ore, as the concentration of the material has always been attended with such large silver losses that the margins were too small. With the opening up on the Highland Boy group of large bodies of workable copper ore, all this has changed; Bingham is now the principal copper district of Utah and promises to be of increasing importance in the future.

The Highland Boy continues to be the largest producer. This company treats its own ores, using reverberatory furnaces, and has shipped about 500 tons per day during the year. The available tonnage has been increased by a series of strikes in the limestone beds overlying the old ore-bodies, so that to-day the mine is more prosperous than ever. The next to open up and establish its own smelting plant was the Bingham Consolidated, owning the Commercial group. This company operates a blast furnace, and purchases large amounts of siliceous ores in the open market. The shipments from the Bingham Consolidated have therefore been chiefly fluxing material, and these have averaged about 250 tons per day. This smelting plant is handling about 500 tons per day, converting the mattes, as does the Highland Boy.

The latest addition to the shipping list is the United States Mining Company, which has erected a complete smelting plant, and is now supplying it with 300 tons per day from Bingham mines, obtaining the needed amount of siliceous ore from the Centennial Mine at Tintic. This tonnage will soon be increased to 100 tons, which is the capacity of the smelting plant.

This plant employs blast furnace treatment without roasters, and produces matte for the converters by two passes through the blast furnaces. They have an unlimited tonnage of ore in the Bingham properties, and they will no doubt be the largest shippers from Bingham during the year 1903. Encouraged by these developments work has been prosecuted on a number of adjoining groups, and the result is that at least two are now in such condition as to warrant the erection of smelting plants to handle their ores. These are the Boston Consolidated and the Yampa Mine of the Tintic Mining and Developing Company. Both these properties adjoin the Highland Boy ground; the ores are quite similar in character and value, and both mines have been

quietly but systematically developed to a point where each can supply enough ore for an independent plant. The recent opening of the ore zone in the Yampa at a depth of 1,800 feet, on the dip of the vein, by a tunnel, and the development there of ores of better grade than in the upper workings, is of great importance to Bingham, as it proves that these bedded deposits do go to the deep where there is no disturbance of the formation.

In the main Bingham Canyon the immense deposit of impregnated porphyries has been steadily developed by Col. Wall and by the Columbia Copper Company. There is an enormous quantity of this material, and there is strong probability that the success attained by the working of the little mill on the Columbia will result in the building of a much larger mill during the year, for the working of these ores. The concentrates produced carry about 25 per cent copper, they find a ready market at the other smelters, and it is therefore unlikely that any new smelting plant will be required for these properties. Shipments of fluxing lead ores from Bingham have almost ceased to be a factor in the market. This is caused by the increase in the smelter charges, or rather by the decrease in the payment for iron excess, which amounts to the same thing. During this year only one large body of lead ore has been developed (in the Kempton), and this is tied up by apex litigation.

The fall in silver does not affect Bingham to the same extent as Park City, as the Bingham ore does not as a rule carry more than a few ounces to the ton. The fall in copper is much more serious for Bingham, amounting as it does on the 3 per cent ores to \$3 per ton, from the highest quotations. Nevertheless the Bingham ores in combination with the siliceous material from Tintic, etc., form the basis of a copper production which will be as cheap, or cheaper, per pound of copper produced as any in the country.

From the foregoing it is evident that the production of Bingham will increase during 1903.

Tintic.—This district comprises several little towns, Eureka, Mammoth, Robinson, Silver City, all lying in the hollows sloping from the same mountain.

The principal shippers from the Eureka District, namely, the Bullion Beck, Eureka Hill, Gemini, Centennial, Eureka, have been rather quiet during 1902. The mills of the Bullion Beck and the Eureka Hill have been idle, such ore as has been taken out in prospecting work having been shipped to the smelters.

The Gemini has been the most prosperous, having been in bonanza for some time, and shipping very good ore from the lowest workings yet attained in the camp. This is the more important as the ore in question comes from below the ground water level; it is sulphide ore in place of the oxidized material found in all the other adjoining mines, and it has proved richer than the upper ore-bodies, indicating that the water level is not a bar to persistence.

The Centennial Eureka, having finished shipments on a large contract to the American Smelting and Refining Company has shut down, pending the completion of the United States Mining Company's smelter, to which concern this mine now belongs. During the coming year this mine will be a steady producer from the very large reserves opened up during the period of rest.

The ownership of this mine, with its siliceous ore, places the United States Company in a most independent position, from a metallurgical standpoint. At Eureka the Eagle & Blue Bell promise well for the year 1903, the mines are now shippers of moderate amounts of good ore, and are opening large bodies of low-grade material. At Mammoth the Mammoth Mine has run its stamp mill most of the year, and has shipped a large tonnage of concentrates to the lead smelters. This mine is developed to the 2,100-foot

level, but has not yet reached the sulphide ores. It has, however, opened up some new ore-bodies of good promise.

The litigation between this mine and the Grand Central has not been settled, and has prevented both properties from paying dividends. The Grand Central is now opening up new ground, the low-grade dumps are being shipped to the copper smelters, and this mine will no doubt be in 1903 a larger shipper than in 1902. In the adjoining properties, the Ajax, Lower Mammoth, Sioux-Ajax tunnel, much work has been done, and a good deal of good ore has been shipped. The Lower Mammoth is the largest shipper in this group.

It is not safe to make predictions concerning any Tintic property, however, when an ore-body is found in the limestone formation of this district it is usually of such proportions as to rank as a bonanza.

At Silver City matters are looking rather blue. The mines of this district are all in porphyry instead of the limestone, all are fissure veins, carrying pyrites, with lead or copper containing silver values. The Swansea and South Swansea used to be the largest producers; both are now closed down, having exhausted their lead ore-shoots to the point where pumping became onerous, and the raise in charges on fluxing iron and the drop in silver together make the lower grades unprofitable. Both have important reserves which may be drawn upon when better conditions prevail.

This camp was boomed in 1901, and many properties were opened, but none have proved steady shippers, the values in most of them failing with increasing depth.

Following round the south side of the mountain the Star Consolidated, the Carissa, Northern Spy, may be mentioned. All were unsuccessfully boomed, and are now undergoing a period of quiet development which may be productive of good returns in the near future. They have reserves of low-grade ore, which are adversely affected by the fall in the prices of silver and copper. At this end of the camp the values are largely in copper, much of it the result of secondary deposition and poor in the precious metals.

On the east slope of the mountain are the Sioux, Utah, Yankee Con, May Day, Uncle Sam and Godiva.

These are in the limestone, and have followed shoots of ore which underlie the contact between two limestones, of widely different character. These shoots have mainly had a horizontal extension, so that they have all failed with increasing depth. All have been shippers of lead-silver ores, carrying gold; all have large reserves of low-grade ores, and all have ground now undergoing development which may prove profitable. The May Day has erected a dry concentrating plant, but up to date the results have not been up to expectation.

The ores of the Tintic district are (with the exception of the Swanses) siliceous ores, no matter whether the values are carried by a lead or a copper base; thus these ores are subject to higher smelting charges, the freight to the custom smelters is also higher than from Bingham, and for this reason an ore of \$12 to \$15 gross value in metal contents is not profitable, whereas in Bingham an ore of \$6 value is considered payable. Water is scarce in the limestone mines, but plentiful in the porphyry. It would seem as if a combination of properties, and of ores, could be effected by which a local plant would secure a smelting mixture, and therewith create an outlet for the low grade production.

It is not probable that the total output of Tintic will increase during 1903, unless the unexpected happens.

Mercur.—In this district the steady old Mercur Mine is the great producer of gold ore, and

it has kept up its tonnage, with, however, a small diminution of the net output owing to added expenses of extraction in depth and to increasing baseness of the ores. It can be relied on for about the same production in 1903. The Sunshine and Sacramento are about the only other mines left from the long list once working; these have both been busy, and have made small but steady outputs, which they will no doubt continue.

Ophir & Stockton.—These camps have been intermittently productive. Senator Clark's Ophir Mine has been the largest shipper, sending daily about 75 tons of lead-copper concentrates to the custom plants. This will no doubt be repeated during the coming year. At Stockton the completion of the Honerine drain tunnel will allow production to begin on the large ore-bodies of this mine, and these shipments will swell the tonnage from this district.

Gold Mountain.—The Annie Luarie Mine at Kimberly is now handling about 300 tons of \$10 ore daily in its cyanide mill, and this production will be increased in the spring. This is the only producer in the district, but others are coming to the front in this promising district.

Frisco.—The old Horn Silver Mine has not been a large shipper; shortage of water has kept the concentrating mill idle, and until a method for handling the zinc ore of the mine is devised the shipments will not be largely increased.

The Cactus is being rapidly developed, and promises to become one of the large copper producers of the coming year, as its large bodies of low-grade concentrating ore are to be utilized as soon as the mine has been equipped with a new plant.

Big and Little Cottonwood.—These camps, the home of the old Emma Mine, Flagstaff, and other old producers, are the scene of active prospecting work, and this coming year may bring them both prominently into the ranks of producers.

By way of summary we can therefore say that 1903 should show a very substantial increase in the output of metals from Utah mines, notably in the amount of copper, on account of the recent equipment of the larger properties at Bingham.

THE BOUNDARY DISTRICT OF BRITISH COLUMBIA IN 1902

By Our Special Correspondent.

The mineral production of the Boundary District for 1902 in tonnage exceeded by nearly 20,000 tons the production of 1900 and 1901 together. The increase over 1901 would have been much larger but for serious shortages in the coke supply of the smelters and insufficient power to run the Granby Company's smelter at full capacity. The output of the mines could, without difficulty, have been increased by 100,000 to 150,000 tons. The output for 1902 was about 504,000 tons; the exact figures are not available yet, and the tonnage shipped during December is estimated:

	Ore shipped to Nov. 30, (incl.)	December (Estimated).	Total.
	Tons.	Tons.	Tons.
Granby, Consolidated Mining Smelting and Power Company, Old Ironsides and Knob Hill Group	280,601	30,000	310,601
B. C. Copper Company, Mother Lode Mine	122,577	15,000	137,577
Snowshoe Gold and Copper Mines, Limited, Snowshoe Mine	15,940	4,860	20,800
B. C. Chartered Company, B. C. Mine	11,627	3,000	14,627
Montreal and Boston Copper Company, Sunset Mine	6,750	1,260	8,010
Dominion Copper Company, Emma Mine	6,700	1,200	7,900
Jewel Gold Mines, Limited, Jewel Mine	2,175	....	2,175
Winnipeg Mines, Limited, Winnipeg Mine	785	....	785
Golden Crown Mines, Limited, Golden Crown Mine	625	....	625
No. 7 Mining Company, No. 7 Mine	532	....	532
Providence Mining Company, Providence Mine	132	40	172
Sundry small shipments	158	....	158
	448,602	55,360	503,962

For purposes of comparison the following figures of the larger shipping mines are given:

	1900. Tons.	1901. Tons.	1902. Tons.	Total. Tons.
Granby mines	64,531	231,762	310,601	606,894
Mother Lode	5,564	99,548	137,577	242,689
B. C.	19,618	47,517	14,627	81,762
Snowshoe	297	1,731	20,800	22,828
Sunset .....	....	800	8,010	8,810
Emma .....	....	....	7,900	7,900
Jewel	160	325	2,175	2,660

There was very little ore shipped during the first half of 1900. The B. C. Mine's small shipments for 1902 are due to the mine having been shut down the first half of the year.

Regarding the value of the ore produced during 1902—since the product of all the Boundary mines that shipped more than 1,000 tons, the B. C. and Jewel mines excepted, averages higher values in copper than in gold, in most cases higher than in gold and silver combined. The big drop in the price of copper at the close of 1901 affected the value of the output very materially. Ore containing an average of 2 per cent copper, or 40 pounds to the ton, with the average price of copper in New York for the year 5 cents per pound lower during 1902 than during 1901, declined in value \$2 per ton, a big depreciation in ore previously estimated to be worth only \$6.50 to \$7.50 per ton gross, with copper at the higher figure. Similarly ore containing only 1 per cent copper depreciated in value \$1.50 per ton. There was also a gradual decline in the average price of silver, but the silver content of most of the Boundary ore is too small for this alone to make much difference. The lower prices of copper and silver reduced the total value of the year's mineral production from \$750,000 to \$1,000,000, a serious matter for a district in which the mining industry is struggling for a permanent foothold. But it suggests one encouraging consideration, viz., that if it be possible to work the big low-grade mines without loss under such disadvantageous conditions, they should be remunerative investments for capital after the price of copper has recovered a couple of cents per pound.

Unfavorable conditions affecting costs of mining were the comparatively high cost of labor and of supplies, especially explosives, while the price of fuel and freight rates added much to the cost of smelting. Some progress has been made towards lower costs. The open cut system of mining has enabled mine owners to, in a measure, offset the results of the eight-hour law, which made it impossible to work without loss some of the mines in the ordinary manner. Longer hours now prevail in the big ore quarries and in the big mines the labor cost is reduced proportionately. It is hoped that it will be possible to ere long obtain dynamite at a lower cost. It is claimed the actual cost of manufacturing 40 per cent dynamite on the Coast is only about half the price charged in the Boundary. About three-sevenths of the difference is for freight, the remaining four-sevenths is the manufacturers' profit. There does not seem to be any immediate prospect of relief for the smelting industry as regards the cost of coke and railway freights, but the outlook is favorable for railway competition and lower fuel costs before the end of 1903.

In addition to the increased ore production the installation of more powerful machinery at several of the mines, the enlargement of the treatment capacity of the smelters, and the completion of works for generating electric power are evidences of substantial progress. At the Granby Company's mines a 60-drill air compressor and a large ore crusher, both to be driven by electricity, are among recent improvements. The Snowshoe has put in the first half of a 30-drill air compressor, and is adding an electric hoist. A big ore crusher has been at work at the Mother Lode Mine the greater part of the year, with excellent results. The Sunset has also added to its plant, while the Emma has been provided with steam power equipment. The most important additions to smelting facilities were two sets of converters

and two more blast furnaces at the Granby Smelter at Grand Forks. The B. C. Copper Company added another blast furnace, while the Montreal & Boston Copper Company secured possession of the smelter at Boundary Falls and began smelting operations with one furnace last summer, and is installing a second furnace. During the year the record work done at the Greenwood Smelter was the subject of favorable notice and commendation in the ENGINEERING AND MINING JOURNAL.

Several properties in the vicinity of Greenwood having narrow quartz veins carrying high values in gold and silver are being developed. Of these the Providence has shipped 132 tons of ore returning from \$100 to \$150 per ton after payment of freight and treatment charges. The Goldfinch sent out about 40 tons, worth about \$40 per ton net. There are at least three others under development, and more will probably be working ere long.

The continued neglect of the provincial government to complete the wagon road up the West Fork of Kettle River has had the effect of paralyzing mining development in one of the most promising sections of the Boundary. It is well known that in the neighborhood of Beaverdell and Carmi, respectively, there are at least half a dozen properties upon which sufficient development work has been done to demonstrate veins of ore carrying high values in silver. The completion of this road next spring has lately been promised, so that a change for the better may be expected.

On the whole, the prospects of the Boundary District for 1903 are encouraging. With the producing ability of the mines and the capacity of the smelters both on the increase, a reasonable expectation of an appreciable improvement in the price of copper, the near approach of railway competition, and the all-round better results gained by experience, there is much to incite further effort and to ensure eventual success.

GOLD MINING IN SOUTH AFRICA IN 1902.

By W. FISCHER WILKINSON.

During the year 1902 the gold mining industry of the Witwatersrand made steady progress towards regaining that leading position among the gold-producing countries of the world which it held before the outbreak of the war in October, 1899.

At the commencement of the year war was still being carried on, and the work of reorganizing the mines was naturally beset with difficulties. The work of reconstruction which had already been taken in hand in 1901, and indeed on a smaller scale in 1900, was advanced as rapidly as circumstances permitted. Mines were unwatered, machinery and plant were overhauled and preparations made generally for a resumption of operations. The Government at the same time was revising the laws and setting up the machinery for their proper administration, so that when peace was declared on May 31 the country was in a position at once to receive back large numbers of the civilian population without the disorder, confusion or delay that would certainly have taken place if no attempt had been made to establish a civil administration before the close events preceding.

Before dealing specially with the year 1902, it may be of advantage to give a short review of the previous events.

The gold production of the Witwatersrand Gold-field, which had been discovered in 1884, had in 1888 reached the value of about a million sterling, and from that date rose rapidly, year by year, until in 1898 it had reached a total of over £16,000,000, and had taken first place among the gold-producing countries of the world.

During 1899 the gold production continued to increase, month by month, and if the war had not broken out, the total production for that

year would probably have amounted to £20,000,000, equivalent to about \$100,000,000.

On October 9, 1899, the Boer ultimatum was delivered and on October 11 war was declared. The majority of the mines had closed down when war appeared inevitable, but 12 mines, 6 of which were worked by their own board of directors and 6 by the Boer Government, continued in operation until the occupation of Johannesburg by Lord Roberts on May 31, 1900, when all mining ceased.

It is only natural that during war-time the collection of statistics should fall into abeyance. The returns, however, for this period have been carefully collected by the Chamber of Mines so that a complete record of the gold production of the Transvaal can be compiled. The accompanying tables, A and B, show the gold production of the mines of the Witwatersrand District, and of the whole of the Transvaal, from which it will be seen that the production of the outside districts is insignificant compared with the Transvaal itself.

Table A.—Gold Production of the Transvaal.

Year.	Value.	Year.	Value.
1884	£10,096	1894	£7,667,152
1885	6,010	1895	8,569,555
1886	34,710	1896	8,603,321
1887	169,401	1897	11,653,725
1888	967,446	1898	16,240,630
1889	1,490,568	1899	15,728,693
1890	1,860,645	1900	1,510,131
1891	2,924,305	1901	1,096,051
1892	4,541,071	1902	*7,233,216
1893	5,480,493		

* Figures are estimated.

This table includes the production of all mines in the Transvaal and is compiled from the reports of the State Mining Engineer, except for the years 1899, 1900 and 1902 when the Chamber of Mines Statistics are used. The December figures of 1902 are non-official.

Table B.—Showing Tonnage Milled and Value of Gold Produced by the Witwatersrand District.

Date.	Tons Milled.	Value.	Value per Ton Milled.
1884-89	1,000,000	2,440,000	48.8
1890	730,350	1,735,491	47.4
1891	1,154,144	2,556,328	44.3
1892	1,979,354	4,297,610	43.4
1893	2,203,704	5,187,206	47.0
1894	2,830,885	6,963,100	49.3
1895	3,456,575	7,840,779	45.2
1896	4,011,697	7,864,341	39.2
1897	5,325,355	10,583,616	39.74
1898	7,331,440	15,141,376	41.3
1899 January-October	6,639,355	14,046,686	41.15
1899 Nov.-Dec. & supplementary	233,395	1,020,787	4.38
1900	459,018	1,510,131	65.82
1901	412,006	1,014,687	49.25
1902	†3,414,636	†7,179,945	†2.05

* Incomplete.

† Returns for December are estimated.

The high value recovered per ton milled during the war is due to the fact that the richest portions of the reef only were worked and also to the inclusion of special plate scrapings and clean-ups, so that no fair comparison with previous years is admissible.

Some difficulty has been experienced in adjusting the figures for tonnage and values of the supplementary returns for 1899 and 1900, owing to the fact that one return covers the period November, 1899, to May, 1901.

The losses sustained by the mining companies on account of the war have been very heavy. As a matter of interest, the following figures are given, showing what the losses have been:

The gold taken by the Government of the South African Republic, either from trains, banks or from the mines themselves, was £2,697,173; of this amount, £221,995 was recovered by the British Government, £20,630 was smelting losses, £582,310 is unaccounted for, and the balance was used by the Government of the South African Republic.

The net loss of gold to the mines was £2,475,178. Besides this, the loss sustained for caretaking, unwatering, repairs, salaries and wages was

£3,400,000, or a total of nearly £6,000,000, exclusive of interest on capital.

The period from June, 1900, to April, 1901, was one of inactivity as far as the mines were concerned, but in May, 1901, permission was granted for crushing to be resumed on a small scale, and three companies made a start with 150 stamps, and by December of that year the number was increased to ten companies, with 653 stamps. The value of the output for the year 1901 was £1,014,687.

The commencement of the year 1902 found the war still going on, though with diminishing inconvenience to the mining community. The railways were in the hands of the military authorities, and only a limited amount of supplies for civilian wants could be brought up from the coast; labor, too, was scarce, and of an indifferent quality. In spite, however, of many difficulties, additional stamps continued to be dropped, and when peace was signed on May 31, 1902, there were 2,095 stamps at work out of the 5,970 stamps that were in operation before the war.

In the following tables C and D, which are compiled from the returns of the Chamber of Mines, figures are given showing the monthly production of the Witwatersrand and outside mines for the year 1902:

Table C.—Transvaal Chamber of Mines, 1902. Witwatersrand Returns.

Date, 1902.	No. of cos.	Tons Milled.	No. of Stamps.	Fine Gold, ozs.	Value.
January	21	143,756	1,075	70,341	£298,786
February	22	158,151	1,260	81,405	345,782
March	29	211,727	1,540	104,128	442,302
April	33	241,141	1,760	119,588	507,980
May	37	291,479	2,095	138,602	588,746
June	37	282,953	2,130	142,780	606,493
July	38	310,358	2,285	149,179	633,674
August	39	331,665	2,395	162,751	691,322
September	40	334,639	2,460	169,377	719,468
October	41	355,952	2,570	179,660	763,149
November	*42	*369,215	*2,695	182,749	*776,683
December	*43	*383,600	*2,800	*189,543	*805,560
		3,414,636		1,690,103	£7,179,945

* The November and December figures are unofficial and estimated with the exception of the fine ounces of November.

Table D.—Transvaal, Year 1902. Value of Gold Produced by Outside Mines Other than those on the Witwatersrand.

Date, 1902.	Value of Gold Produced.
August	£2,359
September	3,695
October	7,557
November	19,600
December	*20,000
Total	£53,271

* Estimated.

The main obstacle to rapid progress has been, and still is, the scarcity of native labor. The demand far exceeds the supply. Before the war there were nearly 100,000 natives employed, and even then the complaint was that the mines were short of their full complement. The number of natives working during 1902 has averaged less than half that number. In April, 1902, there were 32,424 natives employed on the mines, and in September, 42,218. Recruiting agents have been hard at work in all the native districts where labor can be engaged, but have been far from successful in satisfying the requirements of the mines, and it appears that new sources of supply will have to be found to meet the growing demand of the Rand for cheap labor. There are serious objections to the importation of Asiatics, and white labor for unskilled work is altogether too expensive for all but the richest mines, as has been demonstrated by trials made during the year under review. No doubt there is an intermediate class between the skilled and the unskilled, between that of the laborer and that of the artisan, in which the unskilled white may be

advantageously employed, but for the lowest class of labor the great bulk of the mines of Transvaal are dependent on the African native. A large proportion of the gold-bearing reefs are of low gold contents, the profitable working of which can only be carried on with low working costs, so that unless cheap native labor is forthcoming, this wealth, in the development of which a large white population would, along with the native, have found employment, will remain unproductive.

It is impossible within the limits of this article to deal fully with this important question, but a few reasons may be given to explain why the numbers have not been brought up to the figures of 1899. A large number of natives have made high wages in the service of the army, and having made considerable savings, have no necessity to seek employment at the present time. Then, again, the field of employment has widened since the war. Many natives who no doubt formerly worked on the mines, are now employed on public works and railways, and as domestic servants, where they obtain as good if not better pay. A further reason which would account for the shortage of labor is that the natives who remained in Johannesburg through the war have gone back to their homes, and like their friends who found employment with the army, think fit to take a long holiday.

It has been urged that the rate of pay offered by the mines, which was reduced from the amount paid before the war, has been keeping the natives from coming in to work, and it was recently decided to again raise the scale of wages and to introduce a system of payment by results or piece work, thereby offering a premium for efficiency.

The solution of the labor problem has not yet been arrived at, but it seems probable that in the future labor will be largely drawn from Central Africa. The opening up of Africa is proceeding with great rapidity, new railways are making accessible districts which up to now have been far removed from civilization. The Uganda Railway, for instance, has reached the shores of Lake Victoria, upon which a fleet of steamers will doubtless be running before long. Cape Town and Beira have through railway communication, and the line now in course of construction from Bulawayo to the Zambesi will widen the area from which native labor can be recruited. There is every reason, therefore, to hope that the opening up of new routes to the heart of Africa will go a long way towards solving the labor difficulty which is at the present time interfering so seriously with the economic progress of the Transvaal.

On account of the scarcity of native labor great attention has been paid towards obtaining greater efficiency and economy in the working of the mines and labor-saving devices, especially belt conveyors, have been put in where possible. The introduction of the system of paying the native by results, offering as it does encouragement to the worker to do his best, should have a good effect. In former years payment was by shift, the good and the bad receiving a like reward. It is also gratifying to record that a stringent administration of the liquor law has made the natives as a body more efficient. It was estimated that under the late administration from 20 to 30 per cent of the natives were incapacitated from work through drunkenness. Now it is usual to have only 5 per cent on the sick list.

During the past year the industry has profited from a considerable reduction in the price of explosives, and a saving has been effected in coal, which in many mines is now delivered in bulk instead of as formerly in sacks. Railway sidings have been made to a large number of mines, thereby reducing the cost of carriage.

Some import duties have been reduced or removed, but railway rates have not been altered, and still bear heavily on the mines. The profit

tax, which stood at 5 per cent before the war, has been raised to 10 per cent.

The final effect of the new conditions cannot be accurately gauged at present, owing to the fact that most of the mines have not been able to work their batteries full time. Working expenses have consequently been, on the whole, abnormally high.

The following tables E and F show the dividends declared for 1902 and for previous years:

Table E.—Witwatersrand Mines. Dividends Declared in 1902. Up to December 20.

Name of Company.	Issued Capital.	Per Cent.	Amount.
Angelo	£275,000	40	£110,000
Bonanza	200,000	115	230,000
City and Suburban	1,360,000	10	136,000
Crown Reef	120,000	125	150,000
Durban Roodepoort	125,000	30	37,500
Geldenhuis Deep	300,000	25	75,000
Geldenhuis Estate	200,000	25	50,000
Henry Nourse	125,000	40	50,000
May Consolidated	288,750	30	86,625
Meyer and Charlton	100,000	30	30,000
Robinson	2,750,000	7½	206,250
Treasury	540,000	15	81,000
Village Main Reef	400,000	25	100,000
Wemmer	80,000	125	100,000
Total			£1,442,375

Table F.—Dividend List. Rand Gold Mining Companies.

Year.	No. of Cos.	Amount Paid.
1896	21	£1,530,381
1897	25	2,707,180
1898	41	4,847,505
1899	36	2,933,251
1900	5	.....
1901 .....	.....	415,813

* Non-mining companies' dividends have been deducted from the dividend list of Chamber of Mines.

The outside mining districts have had little work done on them during the year. Barberton made the first output in August and Lydenberg in October. Considerable attention has, however, been paid to the outlying gold districts since peace was declared, and it seems probable that as costs are reduced an increased production from these districts may be expected.

Among the publications of professional interest during the year, the paper by Mr. Hans C. Behr on Winding Plants for Deep Mines, may be specially mentioned. This valuable paper has been discussed both in London and Johannesburg, and the paper with the discussion will probably be published early next year, and will form a volume of the greatest value to all those who are interested in the problems of mining at great depths.*

A paper by Mr. T. H. Leggett and Mr. F. H. Hatch, on the Gold Resources of the Witwatersrand, also calls for remark. Both the above papers will be found in the *Transactions of the London Institution of Mining and Metallurgy*, and have been abstracted in our columns.

An improved method of treating zinc gold slimes is described by Mr. P. S. Tavener in the *Journal of the Chemical and Metallurgical Society of South Africa*, Volume 3, No. 6.

Rhodesia.

The gold production of Rhodesia again shows an increase over former years. Two mines, the Globe & Phoenix and the Selukwe, stand out prominently, accounting during the year ending March, 1902, for 58.3 per cent of the total production.

As in the Transvaal, the working of the mines has been hampered by a scarcity of native labor.

Table G.—Gold Production of Southern Rhodesia (including Tati.) From Report of Rhodesia Chamber of Mines.

Date.	Tons Milled.	Yield of Gold oz. Bullion.	Value.
Previous to Sept., 1898....	11,322	6,470	£22,645
Sept., 1898-June, 1899....	100,506	54,291	192,679
July, 1899-June, 1900....	125,310	65,053	231,127
July, 1900-March, 1901....	148,913	93,207	346,613
April, 1901-March, 1902....	248,002	180,888	650,752
	634,053		£1,443,816
Less Jan. to March, 1902	85,696		164,186
Up to December, 1901..	548,357		£1,279,630

* An abstract appearing in the *Engineering and Mining Journal*, November 29, December 6 and 13 last.

Of this output, 32 operating companies have re-establish the confidence in persistence so

Year, 1902. Month.	Tons Milled.	Bullion.	Value.
January	29,087	15,594	£56,905
February	23,727	13,204	46,852
March	32,882	16,891	60,429
April	23,777	17,559	61,486
May	25,204	19,597	68,847
June	22,484	15,841	56,206
July	21,261	15,225	54,299
August	25,178	15,746	56,867
September	25,157	15,164	55,008
October	30,286	16,849	60,286
November .....	.....	15,923	.....
December .....	.....	*16,000	.....
		193,593	

* Estimated.

Table H.—Gold Production of Rhodesia. From Chamber of Mines Returns.

Date.	Yield of Gold oz. Bullion.	Value
1890 to 1898.....	24,555	£1,279,630
1899	65,303	548,357
1900	91,949	46,668
1901	172,061	.....
1902	*193,593	£11.20

* Estimated.

GOLD MINING IN WESTERN AUSTRALIA IN 1902

By H. C. HOOPER.

Production.—The production during the first eleven months of the year, and an estimated production for December, is given herewith:

Year.	Oz. Bullion.
January	168,159
February	152,692
March	177,505
April	183,531
May	164,226
June	189,620
July	184,227
August	187,975
September	188,167
October	194,327
November	197,197
December	197,000 (estimated)
Total	2,113,622

The production for three years has been:

Year.	Bullion.	Fine Gold.	Value.
1900	1,513,917	1,354,343	£5,752,885
1901	1,841,498	1,669,072	6,088,635
1902	2,113,622	1,814,967	6,620,850
Total	5,469,037	4,838,382	£17,462,370

Of this output, 32 operating companies have produced during the year (estimating December at November return), 1,388,420 ounces of bullion from 1,276,842 tons of ore, equal to 1.085 ounces per ton. The issued capital of these companies is £11,521,643, and the market value of the shares on December 1, £15,375,315. The dividends declared during the year were £1,279,225, or over 8 per cent on the market value. Many of the mines have during the year completed or enlarged their equipment, so that dividends distributed do not represent actual profits, and a very considerable advance in this direction will take place during 1903.

New Discoveries.—No new mines of great consequence have been discovered during the year, but there has been a remarkably steady growth of smaller mines. Private individuals have taken in hand many mines too small for successful English company operations, and conducted them with marked success. This feature of Westralian mining is bound to become even more prominent in the future, and builds for a more solid future of the industry.

Considerable progress has been made towards determining the fundamental question, Do the lodes persist in depth? The Great Boulder working at 1,600 feet, bore-holes results in Lake View, Northern Blocks, Oroya Brownhill, Ivanhoe Extended, Central Boulder at 1,000 feet and below, have all been successful, and have helped to re-establish the confidence in persistence, so rudely shaken by the failure of the Lake View upper ore-bodies.

Economic Factors.—During the year little improvement has taken place in the economic factors surrounding the mines, although working costs have been steadily reduced—such reduction having arisen chiefly from the agencies of management and enlarged and more economical equipment. Wages have been the subject of considerable discussion, and the decision of a forced arbitration at Kalgoorlie, as usual with such commissions, compromised, and thereby increased

wages. One beneficial result was, however, the establishment of a uniform scale at Kalgoorlie.

The Government has continued its attitude towards the industry and further determined legislation has come into force—such as a Workman's compensation act, more favorable to the workmen and more prejudicial to the owner than any other mining region in the world. Slight extensions of the railway have been built, but nothing has been done towards the construction of the great economic outlet of the Gold-field to Esperance Bay. Great agitation has been raised against unjust discriminations in railway rates against the industry, in which freights are four to five times those of America, and in direct and indirect taxation, but complaint has proved useless in the absence of any means of enforcement.

Treatment Progress.—No striking changes have been made in treatment methods during the year, but steady improvement in mechanical and chemical factors have reduced costs and markedly improved extraction, until Kalgoorlie can now claim, without refutation, to have solved the question of treating telluride gold ores. Opinions still differ as to the advantages of the two different methods of treatment, but wet crushing, fine grinding and cyaniding (with or without bromo-cyanide) have found supporters in the new equipment of the Horseshoe and reorganized mill of the Ivanhoe, and the prospective mill of the Northern Blocks, while improvements in dry crushing-roasting cyaniding processes have also made a creditable showing. The coming year should demonstrate finally which is the most advantageous process, but in general the demonstration that rich telluride ores can be successfully and economically treated without roasting, gives Kalgoorlie no mean place in the metallurgical world.

METALLURGICAL PROGRESS IN WESTERN AUSTRALIA.

By ALFRED JAMES.

The most noteworthy event of the year 1902 has been the success attained in the treatment of telluride ores at Kalgoorlie. After the results obtained from the plants installed at the Lake View and Associated, a considerable lack of confidence had arisen in the minds of investors as to the results which were being obtained at the mines, and this lack of confidence was increased rather than diminished by the reports which came to hand of the total charges of realizing the ore when shipped to smelters.

It is interesting to note, however, how this anxiety has been allayed by the successful work done at the Great Boulder Main Reef, Hannan's Star, the Brownhill, Great Boulder Proprietary, Perseverance and other mines.

Of the various processes put forward the roasting and the bromo-cyanide (Dr. Diehl) processes have alone survived. The claim of Dr. Diehl to treat the ores without roasting has been fairly well substantiated at the Hannan's Star with low-grade ores, but it is admitted that with the rich ores prevalent at Kalgoorlie, roasting must be employed and the efforts of the Diehl group have been in the direction of eliminating the refractory material by concentration and roasting this only, the balance being treated by their bromo-cyanide process. The concentrates are estimated to amount to 15 to 20 per cent of the whole ore.

On the other hand, the Great Boulder Main Reef, the first mine to get successfully to work on the sulphide ores, has continued to yield successful extractions of over 90 per cent at the cost of from \$5.25, or 21 shillings upwards, the average for the year being \$6.25, or 25 shillings.

The Diehl costs at the Hannan's Star have been as low as \$5.33, or 21¼ shillings, but this was on low-grade material assaying, after concentration, about 8 dwt. only, and was an exceptionally low month's cost. At the Hannan's Brownhill and the Lake View, where the ores were richer, expenses

were much higher, amounting to \$8.19, or 32¼ shillings, per ton, the cost of bromo-cyanide alone being as much as \$2 or 8 shillings per ton treated, with an average of over \$1, or 4 shillings.

The process to be employed in the future appears to depend largely on the result of experiments now being carried out on concentration; the Diehl process as such, and with it the use of bromo-cyanide, disappearing in favor of the concentration out of the ore of all refractory products, which will be roasted instead of bromo-cyanided.

The approved scheme of treatment will thus consist of wet crushing (because of concentration), amalgamation on plates, concentration, roasting the concentrates with subsequent separate treatment on the lines of that given the tailings from the concentration tables, fine grinding in tube mills, further concentration, the agitation of the tailings and slimes with cyanide solution, and filter pressing.

In this connection it is worth noting that the adoption of wet crushing is on account of the necessity of concentration; and that the ball mill has proved itself a machine of great economy and considerable output. Two ball mills have shown themselves to be consistently capable of crushing over 72 long tons per diem for an expenditure of, say, 32 horse-power.

The heavy stamps employed are doing good duty of upwards of 5 tons each per diem for a consumption of about 3 horse-power per stamp.

The concentration machines employed are almost invariably Wilfley tables, but it is found that with these machines there is a very considerable loss of the fine sulphides, which are carried away with the coarser tailings.

At the Perseverance mill canvas strakes are employed on the tailings from the Wilfley tables, and these actually produce a concentrate of higher value than is yielded by the tables themselves.

It is in this direction that improvement is looked for during the coming year, as the whole question of the successful treatment of the unroasted sands without the use of bromo-cyanide depends on reducing the sulphides present to a minimum amount. In practice it is found that when the sulphides present amount to 0.5 per cent extractions are unsatisfactory.

It is hoped that the oil process may be able to effect a closer saving of the extremely fine telluride and sulphide concentrates; otherwise slime tables will probably have to be adopted.

The tube mills have proved themselves most efficient for the purpose of sliming sands; one standard size mill being able to output 70 tons per day through a 60-mesh sieve, the size of the feed being 12 mesh, with 27 horse-power consumed.

The form of agitator employed is one with radial arms on a vertical spindle suspended from above the top of the vat in which it works. There is no footstep, but the end of the spindle revolves in a guide of cement or iron. Some of the agitators are made with raising gear, so that they may be elevated in case of stoppage, but in practice this gear is but seldom employed.

For elevating the slimes, tailings wheels of the pattern in use in Africa are usually installed, and the multi-bottomed spitzkasten is in successful use, and is now requisitioned for all new plants. This, however, will probably give place to the system now in use in South Africa of one large conical settling vat, which may have either continuous discharge of thickened slime at the bottom, with an overflow of clear water at the top, or, preferably, will work in conjunction with a second conical vat, into which the lower and muddy portion of the decanted solution from the first vat will settle before passing back to the mill.

The filter presses in use are well-nigh universally those of the Dehne type, which have either been procured direct from Germany or made at Australian foundries, and the presses are usual-

ly filled by the use of compressed air, a separate montejus being provided for each class of charge, whether pulp, cyanide wash, or water wash. At the Horseshoe, however, the presses are filled most satisfactorily by plunger pumps, and as this is considerably cheaper than the use of compressed air, which causes a very great waste of power, this system will probably be installed in the new plants.

Of the processes other than the roasting and bromo-cyanide, which were introduced last year, the May and the Riecken have not proved successful, and the works have been shut down. The May process was never regarded seriously at Kalgoorlie, but the Riecken obtained some notoriety, owing to its adoption at the South Kalgoorlie with, it was stated, very successful results, and the subsequent installation of a second plant at the Great Boulder No. 1. It was found, however, at the South Kalgoorlie that filter presses and zinc precipitation boxes had to be employed, owing to the defective electrical precipitation—the essence of the claim—and at the Great Boulder No. 1 it paid to put in zinc boxes to treat the filtrate from the slimes dams; but the recovery was only from 50 to 60 per cent.

With one or two brilliant exceptions, such as the Great Fingall, the year has not been marked by any great advance in the prosperity of the mines in the outside districts, although there is a collective output of considerable proportions from scattered mines.

The year closes with decidedly good prospects for the future prosperity of the Kalgoorlie District. The deep explorations at the Great Boulder, the recent discoveries in the Oroya, the improvement in depth at the Associated and Lake View, and the strike in the Central Boulder all tend to increase confidence in the outlook; and the known improvement in working costs and local conditions, together with the probable advent of the fresh water scheme in Kalgoorlie, all tend to the prosperity of the field.

With no hope of a change in the state-maintained price of labor or the tariff on necessities, a reduction of working costs should be sought mainly in the question of a cheaper method of the production of power, and in this connection it is a matter of surprise that more has not been done in the direction of utilizing water, gas or oil fuel. The cost of carriage of the latter is probably the difficulty in the way, but seeing that there is available right on the spot a supply of green eucalyptus wood, which has been shown to be most suitable for the generation of water gas, it is suggested that the engineers on the spot might give this matter their most serious attention, instead of going to the expense of condensing water heavily impregnated with minerals for the purpose of generating power by boilers.

THE MINING INDUSTRY OF AUSTRALASIA IN 1902.

By F. DANVERS POWER.

The year 1902 will long be remembered as one of depression throughout Australasia, principally on account of the low price of metals, and the prevailing drought. The latter has not only acted directly by forcing certain mining operations to cease temporarily for want of water, but also indirectly by its effect on the general prosperity of these States, for the wool clip is a failure, and this year we will not have sufficient wheat for domestic consumption so that export is out of the question. Other products are proportionally affected by the unfortunate climatic conditions. Mining legislation has not been such as to encourage outside capital to be invested here, and capitalists who would have otherwise spent money in these States have been driven elsewhere. Though the drought has forced many mine owners to reduce their output, and in some cases to close down for a time, where funds have been available, hands have been kept on at development work, which has been pushed further forward than would otherwise have been the case, for there is a tendency in the smaller Australian

mines to live from hand to mouth. When mining conditions are once more favorable, no doubt these developments will make things go ahead. That the present depression is not on account of anything radically wrong with the mines themselves is indicated by the increased yield of gold in the principal States over that of last year, in spite of the drought, and the fact that other mines are ready to recommence work as soon as the prices of copper, lead and silver rise, or they can get a sufficient supply of water. The following table gives the yield of gold for the year:

	1901.		1902.	
	Fine oz.	Value.	Fine oz.	Value.
N. South Wales	216,874	\$4,482,785	260,000	\$5,374,200
Queensland ...	576,920	11,924,936	527,000	10,893,000
S. Australia... (a)	21,939	453,472	45,000	930,150
Tasmania	52,627	1,087,800	75,000	1,550,000
Victoria	743,467	15,367,463	702,000	14,510,000
W. Australia..	1,669,072	34,499,718	1,875,000	38,756,250
Tot. Aust'lia.	3,280,899	67,816,174	3,484,000	72,013,600
New Zealand ..	412,189	8,519,947	450,000	9,301,500
Tot. Aust'asia	3,693,088	76,336,121	3,934,000	81,315,100

(a) Including 18,028 oz. from the Northern Territory.

The combination of adverse conditions has caused some mines to try and meet them by increasing their output with the same management, and being satisfied with smaller profits. By this means, as also by effecting other economies, the Broken Hill Proprietary Company has been able to pay a half-yearly dividend. A proposal was made to amalgamate the principal Broken Hill mines, so as to save in the administration, but it did not meet with a favorable reception.

The Federal tariff is felt more in New South Wales than in any other State, as in the past most goods were entered free. As an instance, where it affects mining, we may cite the Broken Hill mines, where they use Oregon timber for the square sets. They now have to pay a duty of 6d. per 100 feet super on large timber, and 18d. per 100 feet super on smaller sizes, which means 16½ and 50 per cent, respectively, on the f. o. b. value of the timber, and as 47 per cent of the timber used is of the smaller sizes, this is a serious item. But though the tariff affects New South Wales adversely, the other States reap an advantage by interstate free trade.

The total annual consumption of iron in all forms in Australasia is about 350,000 tons, and yet we have no iron smelting works in Australia. Such works have been started in the past in New South Wales, Victoria, Tasmania and New Zealand, but with very little success, and only their wrecks are now to be seen. Two companies have been formed with the object of starting iron and steel works in this part of the world. Both proposed to erect their works in New South Wales so as to be near their fuel supply. One company intended to work the Blythe River iron ores (Tasmania); the deposits are estimated to contain 20,000,000 tons of 63¼ per cent iron, down to water level. The Blythe River Iron Mines, Limited, have a nominal capital of £1,000,000 in £1 shares, of which 500,000 have been issued, and £35,000 already paid up, but the company will have to be reorganized or perhaps liquidated and reformed before it can get a fair start. The estimated total expenditure is £1,109,684, and the calculated output 150,000 tons per annum. It would take 2½ years to get the works going from the date of starting. The site selected for the works is at Ryde on the Paramatta River near Sydney. Vigorous action has not yet taken place pending the passing of the Federal bonus bill, and the duties under Division VIa settled. A 15 per cent all-round duty on pig iron and manufactured iron and steel, would suit them as well as a bonus, but if the bonus bill is not passed or a duty granted, the company will wait for better times. The other iron and steel scheme was started by Messrs. Sanford & Co., of Lithgow, who got up a company in London with a capital of £750,000, the object being to smelt iron ores from Carcoar and Cadia at Lithgow, but they also depended on the passing of the bonus bill or the granting of suitable duties. The labor party in the House of Representatives has blocked the bill for the time being, by trying to make the iron works a national affair, and only granting a bonus to the State that

erected them; however, each State has been approached, and not one of them has any intention of starting such works, so at present there is no immediate prospect of iron and steel works being started by either the Government or by private enterprise. Government metallurgical works have not been a success on the whole in Australia. The Government works at Clyde, N. S. W., have been closed down for some years. In South Australia the Government expended £32,017 on five plants last year, and lost on each of them, the aggregate loss being £26,370 for twelve months. Western Australia has several Government batteries and cyanide works to enable working miners to treat their ores independently of capitalists. Some are worked at a profit to the State, others at a loss, but, anyhow, they have been the means of circulating money. This Government also has a tin dressing plant at Greenbushes.

The Queensland Smelting Company, Limited, is doing well at the Aldershot Works, Q. The Sulphide Corporation, Limited, Cockle Creek, N. S. W., is experimenting with the Sulman-Picard process, the results of which are not yet made public, but it is understood that the process is rather expensive. Ground was leased about 1900 from the Wallsend Company, Newcastle, N. S. W., with the object of erecting nickel ore refining works, but on account of the failure of the London and Globe Finance Corporation, this has not been carried out. The Smelting and Refining Company of Australia (1901), Limited, London, has taken over the works and business of the Smelting Company of Australia at Dapto, N. S. W. The Broken Hill Proprietary Company, which has paid a total of £7,408,000 in dividends, after an extended trial has proved the Huntington-Heberlein roasting process a success, and has adopted the same, which they expect will enable them to treat the whole of the production from the concentration plant, so that there will not be any large parcels available for sale in the future. Broken Hill ores have been treated on a large scale by the Carmichael-Bradford desulphurization process at West Broken Hill with apparent success.

Bucket dredges for gold mining were introduced to Australia from New Zealand, where they had been in successful operation for some years, in 1898 by Mr. C. L. Garland, for use on the leases he had taken up on the Macquarie River in New South Wales. In 1900 there was an attempt to work up a small boom in dredging, but it did not meet with the support of the public. In New Zealand there are still several successful dredges, but in Australia there are very few, and these few are mostly in New South Wales—the Araluen Valley, Araluen Central, Tulloch's, and Perry's, all at Araluen; Jembaicumbene and Kiandra. In Victoria we have the Buckland River, Ovens Valley and Sailors Creek. In Queensland none of the dredges are paying. Various reasons are given to account for the failure of those dredges that are not a success, but the chief causes are want of gold, unsuitable machinery for the class of work, and inexperienced management. There are several centrifugal pumping plants, which are really sluicing plants, though they are termed, dredges, presumably because they are built on pontoons. Copes Creek dredge is one of Kershaw's centrifugal pumps arranged for working alluvial tin.

The Sydney Harbor Colliery, which has a shaft down 2,937½ feet, struck the upper seam for which they were sinking at 2,880 feet from the surface, where it was 2 feet 4 inches thick of bituminous and splint coal, followed by 3 feet to 3 feet 2 inches of dark carboniferous shale, 2 inches inferior splint coal and 6 to 8 inches of bituminous and splint coals. After sinking 29 feet 11 inches another seam of bituminous coal 1 foot 8 inches thick was met with, followed at a further depth of 15 feet 10 inches by a third seam of 3 inches black shale, 3 inches canal coal and 8 inches of carbonaceous clay shale with thin layers of bituminous coal. The company is now driving on the upper seam, and although it was split up in the neighborhood of the shaft, it is gradually increasing in thickness as they proceed. The Greta Colliery, N. S. W., which has been sealed up since the occurrence of the disastrous fire in De-

ember, 1900, was reopened in July of this year, but after a few days had to be resealed, owing to a fresh outbreak among the debris. A small colliery, the Kayuga, near Muswellbrook, N. S. W., caught fire this year and was sealed down; and on the south coast there was also a fire in the Corral Colliery. The disaster of the year was an explosion at the Mount Kembla Colliery on the south coast of New South Wales, whereby 85 lives were lost, besides two leaders of a rescue party; the explosion is supposed to have been due to an explosion of coal dust. The southern collieries of New South Wales have had a very fair year on the whole, and supply nearly all the coke for the various smelting works in Australasia. The western collieries also make some coke, and have been exporting some coal, but are considerably handicapped for want of trucks. There has been some prospecting for oil by means of boring at the mouth of the Warren River, W. A., but the government geologist's report on the field is not very encouraging. The South Australians have also been trying between Meningie and the railway line. In New Zealand boring has been going on for oil at Lake Branner. Nothing of much importance has been discovered at any of these places up to date.

Mine owners have as usual had to put up with some strikes during the year. Coal miners seem specially partial to this form of showing discontent. In Victoria the Outtrim-Howitt and British Consolidated Coal Miners had several disputes which affected 750 men. One strike was on account of the dismissal of one of their fellow unionists, another on account of an alleged injustice in the system of weighing, again the miners objected to work with a non-unionist, and a dispute respecting the cavelling for working places was the subject for another stoppage of work. At the Jumbunna Colliery, also at Outtrim, the men struck because a trucker was dismissed for absenting himself without leave. Victoria has all she can do to keep her coal trade, without being hampered with labor troubles. In Tasmania there have been strikes both at the Cornwall and Mt. Nicholas collieries, while in New South Wales the miners of the Seaham Colliery refused to work because the management would not allow bottom holing, owing to the large amount of dirt being filled by the miners. Some of the Victorian gold mines have also suffered from labor disputes. McEvoy's Mine, Eldorado, which has been working at a loss for a considerable time, though keeping a hundred men at work, found it necessary to reduce the price for blocking from £1 to 17s. per fathom, and drying from 6s. to 5s. The miners struck in consequence, so the owners have ceased work for good. At the Great Southern Consols, Rutherglen, a strike took place because the directors had to reduce the cost of panelling from 14s. to 13s. At the Lyell Blocks, Queenstown, Tasmania, a strike took place because the management reduced the wages of the truckers from 8s. to 7s. 6d. per day.

The Californian market for Australian coal is discouraging. The effect of past strikes in the coal trade, especially in the Newcastle District, is now being felt. The Mammoth Anthracite Coal Company, Queensland, is testing a new coal-field on the Mackenzie River, about 21 miles from the Central Railway, where boring has proved a seam 24 feet thick. In coal production, New South Wales is a long way ahead of the other States, followed by New Zealand, Queensland, Victoria, Western Australia and Tasmania in the order mentioned.

New South Wales Coal Trade.

Year.	Quantity raised.			Exported.		
	Tons.	Average value per ton. s. d.	£ Total value.	Tons.	Value. £	
1892	3,780,968	7.9	1,462,387	2,191,705	1,028,395	
1893	3,278,328	7.2	1,171,722	1,835,090	814,929	
1894	3,672,076	6.4	1,155,573	2,125,125	804,769	
1895	3,738,589	5.10	1,095,327	2,166,230	773,954	
1896	3,909,517	5.9	1,125,281	2,474,907	900,264	
1897	4,383,591	5.7	1,230,041	2,696,623	952,054	
1898	4,706,251	5.5	1,271,832	2,791,796	962,668	
1899	4,597,208	5.9	1,325,799	2,798,523	1,005,794	
1900	5,597,497	6.1	1,668,911	3,369,332	1,273,034	
1901	5,968,426	7.4	2,178,929	3,470,985	1,681,824	

Western Australia still leads the other States as far as gold is concerned, the output of which for October was 194,387 crude ounces, the second highest yield from the State since the fields were opened. Kalgoorlie is the profit producing center of the State. At the Great Boulder Mine a horizontal diamond drill prospecting hole was put in from the 1,600-foot level, which showed payable stone. Next to gold the most valuable metal produced in Western Australia is tin. This is mined in the Greenbushes District.

Mineral Production of Western Australia from Jan. 1 to Aug. 31, 1902.

	ozs. gross.	ozs. fine.	Value.
Gold	1,407,934.60	1,209,813.54	£5,138,961¼
Block tin	367.98 tons.	23,741
Copper ore	1,983	7,187
Iron stone	4,800	2,040
Silver lead ore	35.85	277
Coal	92,365.2	56,560
Limestone	4,929.35	1,221
Total value	£5,229,987¼

South Australia is the smallest gold producer of all the Australian States. Her principal field is at Tarcoola, but the progress made is very slow. But for her copper, the mining interests of South Australia would be very small. Even in that she only comes third among the Australian States, after Tasmania and New South Wales. The Wallaroo & Moonta Mining and Smelting Company has erected a cementation plant to treat the 200,000 tons of slimes already accumulated, estimated to contain 6,000 tons of copper, as well as what will be produced in the future.

Mineral Production of New South Wales exclusive of Gold, for the first nine months of 1902.

	Quantity.	Value.
Coal exported	2,455,880 tons.	£1,221,747
Silver ingots and matte	776,991 ozs.	77,834
Silver lead ores	285,413.9 tons.	1,010,699
Tin ingots and ore	1,089.15 tons.	100,901
Copper ingots, matte and ore	4,888.95 tons.	248,080
Total	.....	£2,659,261

This is a decrease of £666,648 on that of the corresponding period of last year.

Gold is the mainstay of Victorian mining. The Bendigo Gold-field is still to the fore, both in tonnage and dividends, though the Long Tunnel Extended, Walhalla, is the principal gold producing mine in Victoria just now. An act has been passed in Victoria obliging gold buyers to take out a license.

In New South Wales two English-owned mines (the Prince of Wales Mine, Gundagai, and the Post Office Mine, Stuart Town, the latter belonging to the Emma Company, which has been unfortunate both in Western Australia and America), have closed down. But to set this off another English owned property, the Lachlan Gold Fields, Forbes, is on the dividend-paying list. Wyalong and Hillgrove remain the two chief gold reefing districts of New South Wales. The Lloyd Copper Company, Burruga, is closed down for want of water, as are also the Nymagee Copper Mine, and those at Mt. Hope; the Great Cobar Copper Mine had to reduce hands at the mine, and this naturally reacted on their refining works at Lithgow. For a time water had to be trained to Cobar. Like so many other mines in the western district the Mt. Boppy was also forced to suspend operations for a time, while at White Cliffs, the opal mining center, rain just came in time to prevent the necessity of the inhabitants migrating several miles to the nearest water. The Inverell Diamond Fields, Limited, a British venture, which works an alluvial deposit capped with basalt, which yields 1¼ carats of diamonds, valued at 28s. per load, and tin worth 8s. to 9s. per load, is in financial trouble, and it is uncertain whether it will go into liquidation or reconstruct. The King Conrad Silver and Lead Mine, situated in the same district, has gone into liquidation. Most of the tin won in New South Wales comes from the New England District, and there is still a good future before the deep leads in those parts, which so far are scarcely touched. The old Eurioiwie tin-field near Broken Hill has been reopened, and an ore dressing plant erected. It is now compulsory

in New South Wales for mine managers to hold a certificate. This is following in the footsteps of New Zealand; in Tasmania it is optional whether a manager submits himself to examination for a certificate or not. Certificates are also issued in Queensland and Western Australia.

The fine new building of the Sydney Stock Exchange in Pitt Street, was opened during the year. Most of the silver and lead produced in Australia comes from Broken Hill, though on account of the low price of metal the smaller mines are limiting their work to development. The South Mine has increased its output, which costs 3s. 4½d. per ton to mill and concentrate. The British Broken Hill is putting up an electric power plant. The cost of mining and concentrating the ore at Block 10 amounts to £1 os. 6d. per ton. Capt. Warren, who has managed this mine from the commencement, resigned his management during the year. In September of this year the fire that broke out in the same month of 1897, near Brodribb's Shaft, Block 12, of the Broken Hill Proprietary, broke out afresh; this was caused by a movement of the ground allowing air to reach the old smouldering timbers, but the fire was soon got well under control.

In Queensland, Charters Towers, Mount Morgan and Gympie are the three largest gold producing fields in the order named. Operations were hampered at Mount Morgan for want of water which necessitated the closing down of some of the plant until rain came, nevertheless the mine has been worked at a profit and paid dividends. Many of the Queensland mines appear to be placed in such inaccessible localities that it is obligatory for them to have fairly lengthy railways before they can hope to work at a profit. The Einasleigh Freehold Company discharged all hands in April, as they could not pay with the then price of copper until they have a railway. The Chillagoe Railway and Mines have built the longest railway, and Mt. Garnet has a branch from it, while the Stannary Hills Mine proposes to construct a 21-mile branch to their property. The New Chillagoe Railway and Mines, Limited, raised up on the ashes of the Chillagoe Railway and Mines, Limited, has given this district a new lease of life. The company consists of 1,000,000 shares of £1 each; of these 608,886 (the same number that had been issued in the old company) are paid up to 16s., and have a liability of 4s. per share. Of the balance, 250,000 will be held for debenture conversion at par, 20s., and 51,114 shares are to be held in reserve for the present. The Mt. Garnet has proved disappointing, but the Tartana Mine has yielded some good copper ore. The Queensland Registrar of Mines is refusing to register the names of new mines which bear a similarity to those already existing, which tend to mislead the public. It would be well if his example was followed in the other States.

Tasmania, though our smallest State, can give a very good account of herself so far as mineral wealth is concerned. She owns our champion tin mine, also our largest producer of copper. The Tasmanian Mine at Beaconsfield is one of our principal gold mines, which, by the by, is at present under offer to an English Company. There are silver lead mines working on a fairly large scale. The best deposit of iron so far discovered out here is on the north coast. Besides these there are deposits of coal, bismuth, wolfram, nickel, etc. The Mt. Bischoff Mine was discovered in December, 1871, but it did not commence to pay dividends till February, 1878. This mine has turned out 60,310 tons of tin ore, and has paid a total of £1,831,500 in dividends, or £152 12s. 6d. per share. During the first six months of this year it paid regular monthly dividends amounting to £27,000 in the aggregate. The average percentage of the ore from the whole mine is about 1.3 per cent, and mining, crushing and ore-dressing costs 5s. 9½d. per ton. The Briseis Mine is an alluvial tin proposition. The company has a capital of £600,000. Water is conveyed along a race 30 miles long. Present work is confined to removing the heavy overburden, partly basalt and partly granite debris, which varies from 60 to 200

feet deep to the floor of the workings. The Mount Lyell Mines and Railway Company has now absorbed the Mt. Lyell Reserve Copper and Gold Mines, the Glen Lyell Copper Mine, South Tharsis Flux Mine, Royal Tharsis and the King Lyell Mines. The ore produced scarcely assays 2½ per cent copper and the metal-bearing fluxes used not quite 1¾ per cent copper, but they also buy ore from other mines in the neighborhood. They smelt to blister copper. Mining operations cost 4s. 4d., and smelting and converting 16s. 10½d. per ton of ore. The North Mt. Lyell Company appears to have made a mess of a good mine at the commencement, but it is now hoped that the radical changes made by the new management will mend matters. It seems a pity that this siliceous proposition could not arrange to amalgamate with the Mt. Lyell Company, which has an excess of basic ores. They have remodeled the reverberatory furnaces, and built four blast furnaces. In the latter they will smelt the high-grade ores from the mine. The low-grade ore will be concentrated, and the tailings leached. The cement copper, concentrates and matte will then be treated in the reverberatory furnaces. The Hercules and Magnet mines on the west coast have each paid off their liabilities, and now have credit balances at the bank. At present they sell their ore to custom works, but they have been discussing the advisability of erecting works of their own, the chief difficulty being to decide, especially in the case of the Hercules, by what process to treat their ores, for much of the ore that will not pay to ship, is complex, containing a large amount of zinc.

Mineral Production of Tasmania exported during the first six months of 1902.

	Quantity.	Value.
Gold won	34,848 ozs.	£148,024
Auriferous quartz and pyrites exported	110½ tons.	2,115
Silver ore exported	11,991¾ tons.	80,401
Blister copper exported	4,978¾ tons.	359,576*
Copper ore exported	3,136¾ tons.	44,253*
Iron ore exported	1,100 tons.	1,000
Coal raised	22,528½ tons.	19,149
Silver lead bullion exported	2,711¾ tons.	92,666*
Tin ore exported	66½ tons.	2,004
Tin ingots exported	813¾ tons.	99,807
Copper matte exported	150 tons.	3,250
Cyanide slag	½ ton.	150
Total value		£852,395

* Value of gold contents deducted.

Several well-known mining men have been removed by death during the year, among whom may be mentioned Lewis Lloyd, the New South Wales "Copper King." William Williams, formerly known as "Old Gold Dust," who died at Adelong, N. S. W., at the ripe age of 102 years. During his 80 years in New South Wales he acquired £250,000 worth of gold. George Hunt, one of the claimants to being the first discoverer of gold in Australasia; he claimed that he found gold on February 5, 1851, near Lewis' Ponds. Edwin Field, the discoverer of the deposit at Costerfield, which was named after his mate and himself, the largest producer of antimony ever worked in Australia. The Hon. John A. Wallace, as a member of the Legislative Council of Victoria, had done more than any other man to promote the mining industry of the northern portion of Victoria.

THE COMMERCIAL MOVEMENT OF THE PRECIOUS METALS.

The commercial movement of gold and silver during the year 1901 presented some features which, to a certain extent, differentiated it from that of any previous year. In the first place, there was a much smaller exchange of gold between the United States and the different European countries, than has been the case for a number of years past. While the production of gold continued large, as is shown in the first part of this article, the proportion of the metal passing immediately into circulation was probably less than in either 1901 or 1902. The accumulation of gold which for a number of years had been going on in certain countries of Europe, came practically to an end, and was indeed reversed in the case of most of them. The commercial exchange of gold was lim-

ited by certain causes which we will endeavor to develop later.

With regard to silver, the main features of the year was somewhat unfortunate to producers. They were, in brief, a continued production on a large scale; a cessation of the demand from the East; an almost total cessation of any demand for coinage, and a continuous and somewhat rapid fall in price.

The gold movement so far as the United States was concerned, showed a comparatively small balance. We have not as yet the figures for the full year, but the total imports and exports for the eleven months ending November 30 were as follows:

	1901.	1902.	Changes.
Exports	\$53,039,816	\$33,172,063	D. \$19,867,753
Imports	51,970,358	39,861,245	D. 12,109,113
Excess	E.\$1,069,458	I.\$6,689,182	.....

The details of this movement for the ten months ending October 31—the items for November not being completed as yet—were as follows:

Imports of Gold by Countries.

	1901.	1902.	Changes.
Dominion of Canada..	\$20,361,048	\$16,366,931	D. \$3,994,117
Mexico	6,344,796	7,403,286	I. 1,058,490
Central Amer. States.	519,822	676,194	I. 156,372
West Indies	1,408,631	431,360	D. 977,271
South America	993,243	1,242,467	I. 249,224
France	1,179,275	527,347	D. 651,928
Germany .....	.....	15	I. 15
United Kingdom	254,858	2,872,950	I. 2,618,092
Japan	2,665,800	9,855	D. 2,655,945
British Australasia ..	10,731,394	6,326,460	D. 4,404,934
All other countries..	79,813	168,073	I. 88,260
Total	\$44,538,680	\$36,024,938	D. \$8,503,742

Exports of Gold by Countries.

	1901.	1902.	Changes.
Dominion of Canada..	\$2,866,789	\$3,927,211	I. \$1,060,422
West Indies	732,087	822,808	I. 90,721
South America	23,150	1,379,961	I. 1,356,811
All other N. Amer....	59,040	188,596	I. 129,556
France	21,061,373	18,806,515	D. 2,254,858
Germany	9,354,752	4,947,598	D. 4,407,154
United Kingdom	1,261,705	189,550	D. 1,072,155
Hongkong	273,300	42,673	D. 230,627
Japan	220	2,144,136	I. 2,142,136
All other countries ..	1,114,900	8,100	D. 1,106,800
Totals	\$36,747,316	\$32,457,148	D. \$4,290,168

From these tables it will be seen that during the year we drew little or no gold from European countries, the current, in fact, setting the other way. An exception should possibly be made if we take into account the receipts from Australia, which were, however, very much less last year than in 1901. A portion of these receipts is possibly in direct payment for merchandise—principally grain and flour taken from this country—but the greater part of the gold is sent here on British orders, and in payment of British accounts. Apart from Australia, the heaviest receipts of gold in this country were from the Dominion of Canada, and came almost entirely from British Columbia and the Yukon. The decrease shown in 1902 was largely due to the probable smaller production of the Canadian Yukon, but in some measure also to the increased amount remitted from that region directly to Canadian banks, and to the amount retained in the country as currency, as we have already explained. The fact that by far the greater part of the production of these northern mines, comes to the United States, is a still further proof of the statement that has often been made, that the more important mining operations in that country are under the control and ownership of parties in the United States.

Next to Canada, it will be seen that the largest receipts from any one country were those from Mexico. This gold comes here largely in the form of base bullion, black copper, and the like, which are refined and have the precious metals separated at our works. Nearly all the increase, it is probable, was due to the Cananea Mines, the copper from which carries an appreciable percentage of gold.

The other imports of gold were rather unimportant in amount, and were chiefly received in the course of ordinary commercial transactions. The increase in gold from the United Kingdom still left the total from that source comparatively small.

With regard to the exports it will be seen that the largest item was in shipments to France, those to other European countries being very small in amount. These shipments were doubtless in part payment of money borrowed, and represent only a

small portion of the debt which is still to be liquidated. The only other important item of exports was the shipment to Canada, which, however, was for the most part not original, but merely represents the proportion of the Yukon gold which found a more convenient route to Toronto and Montreal by way of Seattle or San Francisco, than through Canadian Territory. The amount sent to Japan last year, while not so very large in itself, represented a movement which was entirely new. These shipments were chiefly made during the latter part of the year, and were generally in considerable amounts, and probably represented government transactions to quite as great an extent as the settlement of trade balances.

From the above statements it is evident that the greater part of the gold mined in this country during 1902 was retained in the country, only a small portion of it, however, entering into circulation or bank balances. It may be asked why, when our trade returns showed throughout the year a heavy excess of exports of agricultural products and merchandise, and while a nominal trade balance for the year was very largely in our favor, there should have been no considerable imports of gold. Many explanations have been offered for this, some partaking of the absurd. The facts, however, as nearly as they can be ascertained in a matter of this kind, are that this trade balance was to some degree offset by the sale of American securities previously held abroad. A much larger part of the balance may be accounted for by the well-known fact that the enormous flotations of industrial stocks in 1900 and 1901 were carried through in part by money borrowed abroad, chiefly in France. A portion of this account has been settled by exports of merchandise, but a considerable part still remains to be provided for. These facts, we think, will explain why we have drawn no gold from Europe during the past year, and why with an enormous nominal trade balance in our favor, the rate of exchange has been against the United States for almost the whole of the year, rising, in fact, several times to a point where large gold exports seemed to be inevitable. These were averted, however, by the rise, at the same time, in the demand for money, and the higher rates of interest offered which made it more profitable for the French bankers, to retain their balances here, than to insist upon their early return.

In Europe, the chief incident of the year was the continued accumulation of gold in France. The table given below shows the balances reported by the chief European banks at the close of 1902, as compared with the similar balances at the end of 1901:

	1901.	1902.	Changes.
England	\$176,742,080	\$161,997,625	D. \$15,644,455
France	492,895,000	508,467,035	I. 15,572,035
Germany	168,450,000	160,270,000	D. 8,180,000
Spain	70,040,000	71,650,000	I. 1,610,000
Neth'l'ds	28,707,500	23,493,000	D. 5,214,500
Belgium	15,190,000	14,940,000	D. 250,000
Italy	79,920,000	83,735,000	I. 3,815,000
Russia	340,995,000	377,450,000	I. 3,645,000
Totals	\$1,371,645,695	\$1,400,742,995	I. \$29,097,300

It will be seen that in England, in Germany, and in the lesser commercial countries, the quantity of gold carried shows a moderate decrease, and that bank reserves are generally down to a much lower point than they were during the trade boom of 1900, and the earlier part of 1901.

In Russia the Bank shows a slight increase, probably in its government holdings, which reflect the success of the Russian Government in negotiating several minor loans during the year, although the state of the markets has not favored the placing of as large an amount on Russian bonds as the Government would probably have desired. In France alone the actual accumulation of gold continues, the Bank of France reporting a total of over \$500,000,000, which is the largest amount ever accumulated in one place, except in the United States Treasury, where a large part of the gold is held in special funds and cannot be freely used as can the bank holdings. In addition to this bank balance in France, there has been unquestionably an increase in the amount held by private parties, a

steady process of hoarding being noted by those who are in best position to observe it. The existence of a very large amount of unused capital is a phenomenon for which full explanations are difficult to find. It can only be said that it is a fact unexampled in recent times.

The gold movement of Great Britain for the 11 months ending November 30 was as follows:

	1901.	1902.	Changes.
Imports	£19,745,531	£19,183,357	D. £562,174
Exports	12,325,740	13,570,898	I. 1,245,158
Excess, imports	£7,419,791	£5,612,459	D. £1,807,332

Changes in imports were a large increase from South Africa, a heavy decrease from India, and lesser decreases from European countries. In exports the decreases were in shipments to the East Indies and to Germany, while there were increases in those to France, India, Japan and South America.

The movement of silver in Great Britain for the 11 months ending November 30 was as follows:

	1901.	1902.	Changes.
Exports	£10,847,123	£9,332,040	D. £1,515,083
Imports	10,586,360	8,448,788	D. 2,137,572
Excess, exports	£260,763	£883,252	I. £622,489

The chief decrease in imports was from the United States, to which the returns credit £6,992,572, or 82.8 per cent of the total, in 1902; against £8,981,366, or 84.8 per cent, in 1901. The chief decrease in exports was in those to China and India.

In *The Mineral Industry*, Volume IV, and in several other previous articles in the *ENGINEERING AND MINING JOURNAL*, we have shown that while it is impossible to fix the amount definitely, it is altogether probable that in average years the proportion of the gold produced which passes into actual circulation, either as coin in the hands of the people, or as coin or bullion held in bank reserve, does not exceed 25 per cent of the total output. In 1900 and 1901, however, it is altogether probable that the proportion rose considerably above what may be called "normal figure," and that fully 35 per cent—possibly 40 per cent—of the gold mined passed into active use and circulation. This is due to the very great activity of business throughout the commercial world, and to the sudden shutting off of the production from the Transvaal mines, the large production of which had done so much towards promoting that activity. The falling off of trade and business in the latter half of 1901 and 1902 throughout Europe, which again can be traced in part to the reduced supply of gold, did much to bring about a return to what we have called the normal consumption, and we may estimate again that not much over 25 per cent—certainly not over 30 per cent—of the gold mined found its way into the shape of coin.

An interesting point, which, we have not the time or space to develop here, is the amount of gold which is yearly lost or disappears. While it is in the nature of things impossible to determine this with any degree of accuracy, high authorities have estimated that such losses amount to about 5 per cent of the gold in actual use or circulation. The causes of these losses are various, including actual abrasion of coin, losses by fire, shipwreck, and the like. To make up for these, a certain portion of the production is necessarily required each year, and in estimating the quantity of gold in active use, allowance must be made for them.

SILVER.

The silver movement during the year was marked, as we have already briefly stated above, by a comparatively light demand from the East, and by the almost total absence of any demand for coinage throughout the year. At the same time, the production remained on very nearly the same level as for several years past. The causes for this continued high output in place of the decreasing demand can be readily found. In the United States, in Australia, and in European countries, silver is no longer a primary product. Very few mines in those countries are now operated for the silver alone. It is

produced in connection with copper, with lead, and to a lesser extent with other metals, and is really a by-product which will continue to be made as long as there is a demand for those metals. The same is the case to a very large extent in Mexico, which is now the greatest silver producing country in the world, although there are still a large number of mines in that country which are worked for their silver alone. The same conditions exist also in Bolivia and other South American countries. Under these circumstances, it cannot be expected that production will decrease to any considerable extent, and the price of silver has, therefore, reflected the conditions of an unchanged supply with a diminishing demand.

The total imports and exports of silver in the United States for the eleven months ending with November, were as follows, at commercial values:

	1901.	1902.	Changes.
Exports	\$50,914,919	\$43,727,779	D. \$7,187,140
Imports	28,358,192	23,701,933	D. 4,656,259
Excess, exports	\$22,556,727	\$20,025,846	D. \$2,530,881

The items for November are not yet received, but for the ten months ending with October the details of the exports and imports were as follows:

Exports of Silver by Countries.			
	1901.	1902.	Changes.
Doninion of Canada.	\$283,282	\$246,668	D. 36,614
West Indies	241,590	164,915	D. 76,675
South America	15,722	271,718	I. 255,996
All other N. Amer.	1,052,532	2,788,861	I. 1,736,329
France	1,050,655	1,113,350	I. 62,695
Germany	4,570	2,530	D. 2,040
United Kingdom	37,978,507	26,978,261	D. 11,000,246
Hongkong	5,308,308	6,517,118	I. 1,208,810
Japan	21,950	21,950	I. 21,950
All other countries	290,452	1,855,174	I. 1,564,722
Totals	\$46,225,618	\$39,963,105	D. \$6,262,513

Imports of Silver by Countries.			
	1901.	1902.	Changes.
Doninion of Canada.	\$2,264,221	\$1,807,615	D. 456,606
Mexico	20,740,525	17,928,323	D. 2,812,202
Central Amer. States.	620,925	442,369	D. 178,556
West Indies	93,903	65,984	D. 27,919
South America	1,526,537	824,442	D. 702,095
Germany	4,720	6,98	I. 2,268
United Kingdom	318	5	D. 313
France	26,641	3,727	D. 22,914
Japan	25,429	11,560	D. 13,869
British Australasia	326	.....	D. 326
All other countries	258,055	417,857	I. 159,802
Totals	\$25,561,660	\$21,502,580	D. \$4,059,080

The absence of coinage orders has not apparently been due to any great changes in monetary conditions. The large coinage of silver in the Latin Union and in Russia in 1901, seems to have given those countries a sufficient supply of silver money for their present needs. This has also been the case with the rupee coinage of India, the balances held by the Government and the banks in that country having been quite sufficient for all needs. The Mexican mints were rather busy throughout the year, partly to meet the demands for dollars for export to the East, but more largely for domestic currency, and it was even necessary early in the year to make some purchases of silver from the United States for that purpose. These purchases, however, did not represent silver mined in this country, but rather silver refined here from Mexican base-bullion.

The demand from the East, which, as is well known, has been relied upon for a number of years, to absorb very nearly one-half of the silver mined in the world, fell off materially during 1902, from a variety of causes. The existence of short crops, and even of famine in some parts of India for several years, reduced the purchasing power of the Indian people to a very remarkable extent, and put a stop for the time to a considerable part of the absorption of the white metal by that country. Not only was there less silver bought from other countries for Indian account, but the short returns and consequent poverty of the people brought out a considerable amount from old hoards, and still further reduced the demand. The most important falling off, however, in exports to the East was to China. The demoralization of business brought about by the war in that country was followed by the exaction of a heavy indemnity from the Chinese Government by the European Powers. Installments of this indemnity were made payable in gold, but the Chinese Government, collecting its taxes in silver, the common currency of the country, has been forced

in order to meet the payments to become an exporter or seller, instead of a buyer of silver, with results that have been disastrous to the trade. This condition of things promises to continue for some time, unless there can be a change effected in the provisions of the treaty. The Chinese Government has asked for this, but the Powers do not seem prepared to grant it.

The following table shows the exports of silver from London to the East, and also those from San Francisco to China and India up to the close of November:

	1901.	1902.	Changes.
From San Francisco:			
Hongkong, for China and India	\$6,484,621	\$7,194,813	I. \$710,192
Japan		21,950	I. 21,950
Total, values	6,484,621	\$7,216,763	I. \$732,142
Total, ounces	11,000,200	13,809,300	I. 2,809,300
From London:			
India	£6,910,410	£5,844,630	D. £1,065,780
The Straits	600,212	162,500	D. 437,712
China	592,412	756,470	I. 164,058
Total, values ...	£8,103,034	£6,763,600	D. £1,339,434
Total, ounces ...	71,734,700	66,911,100	D. 4,823,600

In these tables the quantities are estimated on the basis of average values for the year. The total quantity included in these exports was approximately, 80,720,400 ounces, this year, against 82,734,900 ounces in 1901; a decrease of 2,014,500 ounces.

The average prices of silver in the London and New York markets for two years past have been as follows:

Average Prices of Silver, per ounce Troy.

Month.	1902.		1901.		1900.	
	London. Pence.	N. Y. Cents.	London. Pence.	N. Y. Cents.	London. Pence.	N. Y. Cents.
January	25.62	55.56	28.97	62.82	27.80	59.80
February	25.41	55.09	28.18	61.06	27.40	59.74
March	25.00	54.25	27.04	60.65	27.59	59.81
April	24.94	52.72	27.90	59.29	27.41	59.89
May	24.71	51.81	27.43	59.64	27.56	59.90
June	24.17	52.38	27.42	59.57	27.81	60.42
July	24.38	52.88	26.96	58.46	28.23	61.25
August	24.23	52.52	26.94	58.37	28.13	61.14
September	23.88	51.52	26.95	58.26	28.85	62.63
October	23.40	50.57	26.62	57.59	29.59	63.68
November	22.70	49.07	26.12	56.64	29.66	64.04
December	22.21	48.03	25.46	55.10	29.68	64.14
Year	24.00	52.16	27.11	58.95	28.27	61.38

The New York prices are per fine ounce; the London quotation is per standard ounce, .925 fine.

The table above shows that the fall of silver was steady but gradual throughout the greater part of the year. In October and November, as conditions to which we have referred above were emphasized, and as the market further became alarmed by reports of the existence of large surplus stocks of the metal, the fall became more rapid. About the middle of December there was some reaction caused chiefly by the enforced covering of the speculators in the London market, and December therefore showed some improvement in the average price. This, however, seems to be temporary in its nature, and 1903 opens with silver at the lowest level it has ever known. This low price should properly and normally produce some increase in the consumption of silver in manufactures and the arts. It will doubtless do so in due course of time, but any such condition in this country has been for the time postponed by the unwise action of the combination in which nearly all the manufacturers of the silverware are controlled. This combine has maintained the price of solid silverware very nearly to the point when silver was selling at double its present quotation. We trust that the foolishness of this policy will be made apparent both to producers and users of silver before long, and will result in a corresponding improvement in the demand.

A REVIEW OF THE CYANIDE PROCESS IN THE UNITED STATES DURING 1902.

By CHARLES H. FULTON.

The progress in cyanidation during 1902 consists mainly in the perfection of detail and a more extended application of the process. The greatest activity has been shown in South Dakota, where a number of new and important mills have been erected. The largest cyanide plants in the United States are in this region. The review of pro-

gress in each State is detailed under the proper headings.

Wet crushing of ore by stamps in cyanide solution and the treatment of the slimes by decantation has been much improved during the year, and has received extended application, especially in South Dakota, where this method is supplanting fine dry-crushing by rolls.

One plant, the Sunshine Mine in Utah, has adopted the filter-press method for the treatment of slimes.

Several patents have been granted during the year, and some of these may in time have an important bearing on the cyanide process.

A patent has been issued to Ed. D. Kendall, of Brooklyn, N. Y., for the electrolytic recovery of precious metals dissolved in cyanide solutions: The gold-bearing cyanide solution is filtered through a mass of hard fragmental carbon pocketed around the porous cup of an electrolytic cell, and connected as the cathode of a 15-volt current. A carbon plate as anode is placed in the porous cup and immersed in a solution of caustic alkali. The cyanogen set free collects in the caustic alkali solution of the anode, and the precious metals are deposited in a pulverulent form throughout the mass of the cathode. After the deposition of the gold, the two compartments are emptied of their solution, a silvered carbon plate rubbed with plumbago replaces the former carbon anode plate, the current is reversed and a strong solution of potassium cyanide is permitted to flow through the cell, successively through the anode and cathode compartments in the order named. The gold is redissolved from the former cathode and deposited in reguline form on the silvered carbon plate now forming the cathode. The idea was first suggested by Dr. Pfeleger in 1895, and further developed, and its advantage pointed out, by Prof. S. B. Christy.

A patent (method patent No. 687,258) has been issued to William Orr, of Salt Lake City, and controlled by the Gold and Silver Extraction Company of America, for the recovery of cyanide from waste and foul solutions. The amount of potassium cyanide and potassium zinc cyanide is determined in the waste solution by proper methods, the waste solutions are then run into a suitable tank and the proper amount of fused zinc chloride added to precipitate all the cyanogen as zinc cyanide. The solution is then separated from the precipitate by decantation or filtering, after which a solution of alkali hydrate is added to dissolve the zinc cyanide. The correct amount of potassium or sodium sulphide is then added to precipitate the zinc, which is separated, the solution being again ready for use.

According to R. W. Moore, in the *Journal* of the Society of Chemical Industry, of 80 samples of commercial potassium cyanide imported into the United States, only 24 contained no sodium cyanide, while 50 contained from 10 to 54 per cent of sodium cyanide, averaging 22 per cent, it being evident that much of the cyanide used in the process is a mixture of sodium and potassium cyanide. Under the Dingley tariff, potassium cyanide is admitted under a duty of 12½ per cent, which is one-half that on chemical salts. The question came up for the Board of General Appraisers as to what duty is to be paid on a mixture of sodium and potassium cyanides, and the board's decision was that the mixture be admitted as potassium cyanide.

By a decision of the United States Circuit Court of Appeals, and held as final, zinc dust is admitted free according to paragraph 482, Act of 1897.

California.—A number of new mills have been erected in California during the year, all of small capacity. The industry is carried on principally in Southern California, being better suited to the ores found there, than to those of Northern California. Practically all of the cyaniding is carried on in the following counties: San Bernardino, San Diego, Inyo, El Dorado, Placer,

Shasta, Kern and Mono counties. According to the report of the State Mineralogist, Mr. Lewis E. Aubury, the following plants are in existence, most of them being in operation:

	Tons capacity per day.
San Diego County—American Girl.....	100
Blossom M. & M. Co.....	18
California Kings G. M. Co.....	750
Free Gold Mining Co.....	426
Western Extraction Co.....	50
El Dorado County—Vandalia Mill	200
Shasta County—Medas Mill	48
San Bernardino County—Bagdad Mill	25
Black Hawk Mill	20
Fearnot M. Co.	20
T. K. Mill	16
Rose Min. Co.	70
Yoder Mill	18

A number of cyanide plants of small capacity are in operation and some in course of erection in Inyo County. The Standard Consolidated is operating in Mono County, and a few scattered ones in other counties.

The tailings plant of the Free Gold Mining Company, formerly the Golden Cross Mining Company, at Hedges, San Deigo County, has been at work during the year treating about 425 tons of tailings per day. The process there is described as follows:

The tailings are leached in 5 steel vats of 300 tons capacity each, having 4 bottom-discharge gates, through which the tailings are sluiced out. There are also two 180 tons standardizing tanks and two sump tanks of the same capacity. The vats are filled in 7 to 8 hours, and leached with a 3-lb. potassium cyanide solution, the consumption of cyanide being 0.6 to 0.7 lb. per ton of tailings. At times the consumption is increased on account of the presence of 0.7 to 1 per cent of copper in the tailings. Two pounds of slacked lime per ton are added before leaching. The precipitates from the extractor boxes are treated with dilute sulphuric acid, dried and given a thorough oxidizing roast, after which they are retreated with dilute sulphuric acid to remove copper. The bullion produced is 920 to 940 fine. The zinc consumption per ton of tailings is 0.1 of a pound, and the cost of treatment is stated to be close to 50 cents per ton.

Experiments along new lines are being made at some of the Mother Lode Mines in the treatment of raw concentrates by the cyanide process. The concentrates are ground to 100-mesh or finer, and then agitated. This method is said to meet with considerable success.

The largest plant in the State is that of the California King Gold Mining Company, at Picacho, in San Diego County, near the Arizona line. It has a capacity of over 750 tons per day, and although constructed in 1901, has not yet commenced operations.

Colorado.—A few new mills have been constructed during 1902, mainly of small capacity, the principal one being that of the Tobasco Mining Co., near lake City, Hinsdale County. Some plants have been projected to treat Cripple Creek dumps, and one or two small ones have been built which are said to operate successfully on \$4 to \$5 material when that is suitable. One of these plants is treating the dump of the Pharmacist Mine, and another is soon to be erected in the district by Temple & Crumb, of Colorado Springs. It is to crush coarse, and have a capacity of 50 tons per day. The cyanide plants of the Liberty Bell and Smuggler-Union mines near Telluride, have been in operation during the year, as well as the Gold Run cyanide plant, which treated old accumulated tailings from the Tom-boy and Smuggler-Union mines. The cyanide tailings plant of the Camp Bird Mine, near Ouray, has also been in operation.

The application of cyanidation to the treatment of the Cripple Creek milling ores has received a serious check on account of the preference for chlorination, the Dorcas Mill at Florence being the only cyanide mill in continuous operation. This mill has installed what is known as Begeer's cyanide process. This process con-

sists essentially in passing the cyanide solution, as it comes from the extractor boxes and after standardizing, repeatedly through a centrifugal pump, which is provided with suitable pipes and cocks to allow the absorption and mixing of air with the solution to the fullest extent, causing the solutions to absorb the maximum of oxygen.

At Colorado Springs the Telluride Reduction Co. has erected a bromination plant, in which it is intended to treat the dust by the Riecken process, an electrolytic, amalgamation cyanide process, described and discussed in the *ENGINEERING AND MINING JOURNAL*, Volume 70, page 664, and Volume 71, page 47.

A small plant using the pneumatic process has been erected at the Gold Standard Mine at Idaho Springs.

The process as carried out at the Smuggler-Union Mine during the year is described as follows by Mr. William H. Davis, superintendent of the plant, in a communication to the writer: "The plant was designed and built by F. L. Bosqui in 1901, and began operations early in 1902. There are 16 tanks for the leaching of the ores, arranged in 2 rows of 4 double tanks, one above the other for double treatment. The upper tanks are 40 by 8 feet, and the lower, 40 by 9 feet, all made of California redwood and holding 475 tons of tailings, the daily capacity. Each tank gets a 16-day treatment. The tailings come to the plant by launders, and the tailings are charged into the tanks by Butters and Mein distributors. Overflow gates carry off the slimes. The fineness of the ore is regulated by the height of the column of water over the ore, manipulated by the overflow gates. It has been found that when 30 to 35 per cent of the deposited tailings pass a 120-mesh screen, about the limit is reached at which the tailings will leach satisfactorily. However, as much of the slimes as possible, without impairing the leaching, must be settled. The filling is completed in 24 hours, and then the tank is allowed to drain as dry as possible, after which it is leveled and lime added and a waste solution applied. This waste solution distributes the lime and displaces the water. The waste solution has a high protective alkalinity, and is applied for 18 hours, after which it is displaced by weak solution, which is allowed to leach until the waste solution is nearly displaced. Then the weak solution is allowed to stand on the ore for 24 hours, after which it is leached with weak solution until the tailings are dried for shoveling into the lower vats. The drying is accomplished by vacuum until 15 per cent moisture remains. In the upper tanks the weak solution coming off after the 24 hour contact is the first to carry values in either cyanide or gold. (The weaker solutions do not attack silver at all.) Usually the solutions must carry 0.5 pound cyanide before they have value in them. The solutions from the upper vat treatment are run through the waste solution zinc box, and then are used again as waste solution. With the waste solution go all solutions in the plant running below 2 lbs. per ton.

After the ore is dried in the upper vats it is shoveled into a 6-lb. solution in the lower vats, in which it is allowed to stand for 36 hours. This equalizes the density in the vat, and gives a more uniform leaching, and also equalizes the values in the solution, which carries the highest values and goes to the weak zinc boxes. The strong solution is succeeded by weak solution, then by waste solution, and finally by water. The waste solution is used here in order that the solutions may not be diluted more than necessary.

Zinc shavings are employed to precipitate the value, with good results. The Smuggler-Union ore is a difficult one to treat, the rock being very close-grained and hard. The values are about equally distributed between gold and silver, the latter being present as a double sulphide with arsenic and sometimes with antimony, making a difficult composition to break up. The tailings

are very low grade, but the plant has been a success from a technical as well as commercial point of view, although owing to the recent troubles at Telluride the Smuggler-Union mines have suspended operations for the time being."

At this plant gravity filtration was used to settle out solids and precipitates which formed in the weak solution before it entered the extractor boxes. This was found unsatisfactory, and a filter-press is now used to clarify the weak solutions before precipitation.

A canvas plant has been installed, in which the overflow slimes from the mill are handled by contract. The slimes amount to about 30 per cent of the ore crushed.

According to Mr. Charles A. Chase, superintendent of the Liberty Bell Gold mine cyanide plant, in a communication to the writer, the cost of cyaniding at that plant on a 4,700 ton per month basis, is as follows, in cents per ton:

Labor.		Supplies.	
Foreman	1.5	Cyanide	17.2
Solution men	6.7	Zinc	3.0
Laborers	6.8	Lime	5.2
Assays	2.5	Miscellaneous	0.5
Repairs	0.4	Sulphuric acid	0.3
Total	17.9	Total	26.2

Making a total cost per ton for cyaniding of 44.1 cents.

The Tobasco Mining Company erected a mill at Lake City during the year, which is described by Mr. Smith McKay, of Denver, in a communication to the writer. The rough crushing is done by a 10 by 15-inch Dodge crusher, the product from which passes to 36 by 16-inch rolls for the coarse crushing. The ore is fine crushed by two 30 by 6-inch high-speed rolls. The screening is done by flat impact screens, the final screens having 8-mesh wire cloth. The product from the screens passes to 3 Bartlett concentrating tables, which separate out concentrates consisting mainly of iron sulphides and amounting from 1 to 2 per cent. The tailings from the tables pass to a tank, and from this to a revolving distributor over the leaching vats. The slimes overflow from the vats and are discarded. There are six 18 by 5-foot leaching vats, three 10 by 12-foot solution tanks, two 8 by 10-foot gold storage solution tanks, all tanks being of steel. Precipitation is carried on in zinc extractor boxes by means of zinc shavings. Electric power is used at the mill, being transmitted over a distance of 8 miles. A 75 horse-power motor runs the crusher, elevator, screens and rolls, and a 5 horse-power motor the three Bartlett tables. A 20 and a 5 horse-power motor operate 3 triplex pumps for solutions and water supply.

Montana.—A number of mills have been in steady operation during the year, some new mills have been built and old ones have increased their capacity. The greatest activity is in Fergus county, where the following companies are active, as communicated to the writer by Prof. Alex. N. Winchell, of Butte:

1. The Abbey Cyanide Gold Mining and Milling Company.
2. Barnes & King.
3. Kendall Gold Mining Company.
4. McCormack Brothers.
5. Central Montana Mines Company.
6. Great Northern Mining and Development Company.
7. New Year Gold Mining Company.

The Barnes-King and Kendall properties, near Lewiston, are operating on a large scale, the first having a capacity of 240 tons and the latter 350 tons per day. The Central Montana Mines Company, near Lewiston, has a dry crushing plant of 250 tons capacity, but is treating at present only 100 tons per day.

The large properties above mentioned are treating their ore by direct cyaniding. The ore is quarried and crushed dry to about ¼-inch. As a rule, the values are readily extracted, but clayey

material is occasionally met with, which is unfavorable to leaching. I am indebted to Mr. W. J. Sharwood, of Marysville, Mont., for much of the information concerning Montana and Nevada.

In Lewis & Clarke County, the plant of the Montana Mining Company, Limited, at Marysville, has been modified during the year. Six of the seven leaching vats have been fitted with agitators for the treatment of slimes by decantation. Extensions of sheet iron have also been added to the vats, so that these are now 38 feet in diameter and 13 feet in depth. Charges of 135 tons of slimes are now run through in 48 hours. The original plant has treated over 500,000 tons of tailings. The plant is now shut down for the winter.

At the Empire Mine, near Marysville, a 500-ton tailings plant has been installed to treat the stored tailings. The tailings are conveyed to and distributed in the 500-ton leaching vats by a system of Robins belt-conveyors. The solutions are precipitated by an electrolytic process on plates of sheet iron 3 by 5 feet in size and placed 1 inch apart. These plates divide the tank into nearly tight compartments, and the current passes from plate to plate, one side which acts as the anode being protected by a carbonaceous coating, the other side acting as the cathode on which the gold, silver and copper are precipitated together as a coherent film which is removed by stripping.

Nevada.—No new plants of any size have been built in this State during the year. Several plants have been steadily in operation on the Comstock Lode, treating old tailings from the silver amalgamation mills of early days.

At Tuscarora, in Elko County, the Dexter Gold Mining Company's plant treated 22,930 tons of ore in 11 months, at a cost of \$1.10 per ton, and an extraction of \$1.89 per ton. Near Tuscarora the Montana Mining Company erected a cyanide plant to treat the tailings from the 20-stamp mill on the Lucky Girl group of mines. The sands are treated by percolation, and the slimes by decantation. The Dexter Gold Mining Company experimented with the Godbe agitation process on its slimes, but this was not altogether successful, and attempts are now being made with other methods of treatment.

On the Comstock Lode at Virginia City, Mr. Charles Butters is treating silver-bearing tailings by the cyanide process, using an electrolytic system of precipitation with aluminum cathodes, from which the deposit of precious metals is said to be readily removed by stripping.

At the Charman Mining & Electric Co.'s new wet-crushing plant only a small tonnage was treated, and that by dry-crushing and direct leaching. The plant has now suspended operations. The Ely Mining and Milling Company's plant has also suspended operations. The De La Mar Mining Co.'s plant in this State is shortly expected to resume operations.

The practice in use at the mill of the Horseshoe Gold Mining Company at Fay, Lincoln County, is described by Ernest Gayford as follows: The ore passes over a grizzly, with ½-inch spaces, to a No. 3 Gates breaker crushing to a 2½-inch ring. This product passes to another grizzly, again with ½-inch spaces, whose oversize goes to a style H Gates crusher, all the ore below ½-inch size going to bins of 300 tons capacity. These bins feed into a Gates revolving dryer, whose product is taken by an elevator to a 4 by 8-foot revolving screen of 6-mesh. The oversize from this goes to a set of 36 by 16-inch Gates rolls, the product of which is returned to the screen. The undersize from this screen goes by elevator to two 4 by 8-foot 12-mesh revolving screens, whose oversize goes to two 26 by 15-inch rolls. The product from these rolls is returned to the 12-mesh screens, whose undersize goes by elevator to three 4 by 8-foot 24-mesh revolving screens. The undersize from these screens is finished product, and goes to a 150-ton bin, while the

average goes to an extra 26 by 15-inch Gates rolls, whose product is returned to the 24-mesh screens. The cyaniding is carried on in nine 24 by 5-foot steel leaching vats, which hold 90 tons of dry ore. These vats are charged by cars running on suspended tracks above the vats. The leaching tanks are discharged by shoveling into cars beneath the vats through four 16-inch discharge gates.

There are also three 15 by 9-foot stock solution tanks, which also act as sump tanks, and three 15 by 9-foot gold solution storage tanks. The ore is leached with a 0.3 per cent solution, which is first created by compressed air in the sump tanks. The solution is put on from the bottom, to the extent of 25 tons, and allowed to have 12 hours' contact, when it is drained off and is followed by 30 tons of weak solution 0.16 per cent cyanide, which is drained continuously. This is followed by 8 tons of wash-water, and the sands drained by vacuum until they contain 15 per cent moisture. The total time for one tank from filling to filling is 9 days. Four pounds of quicklime are added per ton of ore at the first crusher. Precipitation is carried on in extractor boxes, 7 compartments, each compartment 15 by 9½ inches in cross section and 16 inches deep. The consumption of cyanide is 0.4 pound per ton of ore, and the consumption of zinc 0.25 to 0.30 pound per ton. The precipitates are shipped to smelters for treatment. The cost of cyaniding is \$1.35 per ton.

Utah.—During the year the Golden Gate and Manning mills have been in operation at Mercur, the latter mill treating old Mercur tailings at a cost of 59.4 cents per ton. The Annie Laurie Mill in Piute County, built in 1901, has been steadily at work and the mill of the Ophir Mining Company in Iron County, situated near the Nevada State line, not far from the Horeshoe Mill above described, has also been in operation. This is a new mill. At the Sunshine Mine at Sunshine, the old mill has been remodeled during the year and a slimes treatment plant installed. The mill has been in operation treating from 100 to 125 tons per day, although it has a nominal capacity of 300 tons per day. Recently the mill was closed for further changes. The process at this mill, which is rather an innovation in slimes treatment in this country, has been described by Mr. M. D. Stackpole in the *ENGINEERING AND MINING JOURNAL* of July 12, 1902. The ore is crushed to 4-mesh, and the slimes, which are considerable, on account of the talcose and clayey nature of the ore, are separated in a special conically shaped separator, the patent of Mr. George Moore. The slimes are agitated in vats by a centrifugal pump, and are separated from the solution by means of four 30-frame filter-presses. This is the only plant, as far as the writer knows, in this country to employ the filter press method of treating slimes.

The Midas Mining Company in the Mercur District, Tooele County, has a cyanide plant in operation treating tailings from amalgamation.

Idaho.—No new cyanide plants of any size have been erected in this State during the year. Several plants have been projected, namely, in Shoshone and Lemhi counties, but none have been erected. The plant of the De Lamar Company in Owyhee County, has been in operation during the year. In its annual report the cost of cyaniding ore valued at \$12.24 per ton is given at \$2.70 per ton, with an extraction of 84.2 per cent; 35,400 tons of ore were treated. The cost of treating old tailings is given as follows, in cents per ton:

Labor	62.42
Chemicals	88.53
Fuel	15.46
Supplies	12.70
Assaying and express	5.10
Total	184.21

The average value of the tailings was \$3.97 per ton, and the extraction 69.7 per cent; 22,900 tons of tailings were treated.

Arizona and New Mexico.—In Arizona several new cyanide plants have been erected during the year, the industry being carried on principally in Mohave, Yavapai and Maricopa counties. The Cyclopic Company at Gold Roads in Mohave County has added to its plant. The cyanide plant of the Congress Gold mine in Yavapai and the tailings plant of the Mammoth Cyanide Company in Pinal County have been in operation. Twelve miles southwest of Prescott the G. & C. Consolidated Mining Company is erecting a cyanide plant. It seems likely that in the next year or two a number of large plants will be built in Arizona. In New Mexico cyaniding has not been very active. A new plant, that of the Last Chance Mining Company, at Mongollon, treats 1,200 tons monthly. It is said on good authority that a 3,000-ton per day plant is projected at Nogal, near the Old Abe Mine.

Oregon and Washington.—Cyaniding has not been active in Washington during the year; the Republic and Red Lion mills at Republic have not been in operation. In Oregon, at Sumpter, are situated the North Pole and Cougar cyanide mills, but these have not been in steady operation. About 18 miles west of Sumpter the Red Boy Mine has a cyanide annex for the treatment of raw concentrates from vanners.

South Dakota.—Greater activity in building new mills has been displayed in this State than in any of the others. During 1902 four new and large mills have been erected, several of which are not as yet completed. The Gayville plant of the Homestake Company, or cyanide No. 2, has been in commission for a few months, with a capacity of 700 tons per day. The wet crushing mill of the Penobscot Mining Company at Garden City, is in operation with a capacity of 125 to 150 tons per day, having just been completed. The Hidden Fortune Company is erecting a mill below Deadwood, which will be running in a short time, with a capacity of 200 to 250 tons per day, with the probability that another section will be added shortly. The Horseshoe Mining Company is building a large plant at Terry, wet crushing to be employed. This mill is to be erected in two sections of 250 stamps each, the second section to be commenced immediately after the first begins operations. The capacity of the plant when finished will be in the neighborhood of 1,000 tons per day. Aside from these three there is under construction a cyanide annex to the stamp-mill of the Jupiter Mining Company in Blacktail Gulch, with a capacity of 50 to 60 tons per day, and a small 5-stamp wet-crushing cyanide mill at Two Bit for the Golden Crest Mining Company, capacity 20 tons. These two plants are being erected by James Hartgering. The Pluma Mining Company is adding a cyanide annex to the old Hawkeye Mill at Pluma, and Hall & McConnell have built a tailings plant at Pluma with a capacity of 60 tons per day to treat the very low grade tailings which accumulated before the lead cyanide plant of the Homestake Company began operations. The old Kildonia chlorination mill of the Horseshoe Company at Pluma has been converted into a dry crushing cyanide mill during the year, and has been in steady operation for the last six months, with a capacity of about 200 tons per day. These additions to the mills already in operation will give the district the following plants in operation in the near future with a chance for an increase during the coming year:

Name of Mill.	Location.	Ore treated per day.
Homestake, tailings plant	Lead	1,300
Homestake, tailings plant	Gayville	700
Imperial Mining Company	Deadwood	125
Golden Reward Company	Deadwood	125
Horseshoe Company	Pluma	200
Horseshoe Company	Terry	500
Spearfish M. & M. Company	Cyanide	250
Hidden Fortune Min. Co.	Deadwood	225
Penobscot Mining Co.	Garden City	125
Wasp No. 2 Mining Co.	Flatiron	100
Dakota Mining & Milling Co.	Deadwood	100

Deadwood Standard M. Co.	Cyanide	125
Portl'd Mill, Columbus M. Co.	Gayville	60
Rossiter or Golden Gate Mill.	Deadwood	60
Alder Creek Mining Co.	Flatiron	60
Jupiter Mining Company	Blacktail	50
Golden Crest M. Co.	Two Bit	20
Highland Chief Plant	Spruce Gulch	50

The total tonnage treated, or to be treated shortly, is 125,250 tons per month. The capacity of some of the plants is in excess of what they are treating at the present time.

The most noticeable feature of the mill construction in the Black Hills during 1902 is that all the new mills are wet-crushing mills. The method is to crush the ore with stamps in cyanide solution, the resultant pulp being separated into sands and slimes by hydraulic classifiers and distributors, the sands are leached and the slimes treated by agitation with pumps, and decantation. When this method was first introduced by Mr. John Hinton in 1899 for those Black Hills siliceous ores which had to be crushed fine, its practical applicability was doubted by many, but the method has certainly demonstrated its usefulness during the last three years, and has practically displaced fine dry-crushing. All of the new mills erected are wet-crushing mills. The dry-crushing mills in the district are the Spearfish, the Deadwood Standard, the Wasp No. 2 and the Alder Creek plants which crush coarse, and the Imperial, the Rossiter, the Golden Reward and the Pluma plant of the Horseshoe Company, which crush fine, the last using dry-crushing mainly for the reason that the plant is the old Kildonia chlorination mill, converted for cyaniding, the rolls and other machinery already being in place. Where coarse dry-crushing is sufficient to liberate the values and make them soluble that method is preferable to wet-crushing in solution with stamps, because in plants of similar capacities the cost of treatment will be less, but where fine crushing is needed it is the general opinion that wet-crushing in solution is better. The dry crushing mill, no matter how complete its exhaust facilities to remove dust from its crushing and screening machinery is always troubled with dust, especially in the tank rooms of the newer mills where belt-conveyors are used in charging the vats. This last trouble has been overcome in an ingenious manner by Mr. J. V. N. Dorr at the Rossiter plant. Here the ore is drawn off at the finished product bin into a trough about 6 feet long, in which is a screw-conveyor. Just above the trough is a perforated pipe, through which a 0.25 per cent cyanide solution is sprinkled into the finely crushed ore (20-mesh), to the extent of 5 to 10 per cent. The screw-conveyor serves to thoroughly mix the ore and solution, and carry it to a 12-mesh belt-conveyor, which, with a short auxiliary conveyor serves to charge the leaching tanks.

This device offers several advantages in that it makes the charging operation practically dustless, lays the ore into the tank in such a condition that percolation is easier and much more uniform, doing away with channelling and also permits more dust to be charged with the ore and still have a leachable product. Another feature a fine dry-crushing that must be taken into consideration with many ores of the district is the amount of dust produced in the comminution and collected by the exhaust apparatus. This in many cases, is too large to permit mixing with the ore without seriously affecting the efficiency of the percolation, reducing the extraction by uneven leaching, and thus necessitating its separate treatment by agitation and decantation in order to overcome the difficulty. This introduces into the dry-crushing mills that adjunct of the wet-crushing plant, the treatment of slimes, which the advocates of dry-crushing object to as expensive and cumbersome. As a general rule, the dust is higher in value than the crude ore.

In the case of the Golden Reward plant the dust amounts to about 4 per cent of the ore crushed, and at the Rossiter plant to about 6

or 7 per cent. In both of these plants it is treated separately by decantation, while at the Imperial plant it is charged with the sands into the leaching vats, being mixed with the sands automatically by a conveyor. While, however, the fine dry-crushing system is open to objections it cannot be said that no unsolved problems confront the metallurgist in the wet-crushing with cyanide solution method. The first of these is the large amount of dilute solution to be handled in the mill. The ratio of solution to ore crushed varies between 3 and 4 to 1, which even in a mill of moderate capacity means a great bulk of solution. The second is the problem of washing the values from the slimes. This would be simple if enough wash-water could be applied but the amount necessary is prohibitive, since it would enormously increase the mill solution. One wash-water is insufficient, and two are in most cases not sufficient. In dry-crushing it is the general practice to use one final wash-water amounting to from 10 to 25 per cent of the ore tonnage, and of this from 6 to 15 per cent, and higher, is discharged as moisture in the tailings, this figure depending on the coarseness of the ore and whether vacuum is applied or not. This practice keeps the amount of mill solution about constant. In washing slimes the percentage of water must be increased, and in order to remove dissolved values more than one wash should be employed. This, however, would so increase the bulk of solution that at frequent intervals some of the weaker solutions would have to be run to waste. When the precipitation of the values is good, and it may not be very good with a weak solution, the amount of precious metals thrown away may be insignificant, but that combined with the loss of cyanide will in time become a serious item.

The extraction from slimes is high, rarely less than 88 per cent, and in some cases above that, but in one mill even with two wash-waters only 80 to 82 per cent is recoverable, the balance going out in the retained moisture with the slimes which are, when discharged, about 50 per cent moisture and 50 per cent solids. Hence, while with fine crushing and the production of slimes a higher extraction is possible, from the nature of the case, the mills are not able to take advantage of it to the full extent and recover it. In order to keep the bulk of solution within limits the wash-water in most cases is cut down, on the sands as well as on the slimes, from what it should be to wash out most of the values, and the total extraction in a wet mill is but little above that in a dry-crushing mill, working on the same ore. Naturally the final test is the question of the relative cost of treatment by the two methods. In one of the older wet-crushing plants of small capacity, 60 tons per day, the cost amounted to \$1.45 per ton of ore treated, this including everything except taxes and insurance. This has recently reduced to about \$1.25 per ton, and it is of interest that the estimated cost of treatment by wet-crushing for a 120-stamp unit of the 1,000-ton Horseshoe plant at Terry is 70 cents per ton. The cost of fine dry-crushing is not available, but is higher than the above figures in most instances. It has been estimated by good authority that a new plant treating 4,500 tons per month can do so for \$1 to \$1.10 per ton. In one of the older mills of small capacity it has been as high as \$3.50 to \$4 per ton. The coarse dry crushing mills, which reduced to 4 to 10-mesh, cyanide their ore for from 75 to 95 cents per ton, based on capacity of comparatively small plants. According to Mr. C. W. Merrill the cost of cyaniding Homestake tailings is now about 35 cents per ton, the mill labor included in this amounting to only 6 cents per ton.

The wet-crushing method has the advantage that weaker solution can be used, the usual battery solution being made up with 2 to 2½ pounds of cyanide per ton, the sands being leached with a somewhat stronger solution, 3 to 3½ pounds

per ton. The usual strong solution for a dry crushing plant is 5 to 6 pounds per ton. The amount of lime is greater for wet than for dry crushing, for while less is used at the battery, considerable is used with the slimes to aid settling.

It has been a problem to get an efficient method of separating the sands from the slimes, for the sands, in order to get a uniform leaching, should be as free as possible from slimes. In the newer mills the crude and rectangular two-compartment separator box has been discarded, and in general a similar method to that used by C. W. Merrill in the Homestake tailings plants is employed. At the Penobscot Mill at Garden City two cone-shaped hydraulic classifiers in series are employed, in which if necessary a rising current of cyanide solution can be used; the overflow from the last classifier goes to the slime vats and the bottom discharge of the two goes by launders to a Butters & Mein distributor over the leaching vats. The peripheral overflow from the sand vats again goes to the slime vats. At the new mill of the Horseshoe Company at Terry, Klein classifiers are to be employed, using an air current introduced at the bottom to aid in the separation. The overflow containing the slimes will go to the slime vats while the sands go directly into the leaching vats. At the new Hidden Fortune Mill below Deadwood the crushed pulp will go directly to Butters & Mein distributors placed above the leaching vats, this separation being deemed sufficient to eliminate the slimes, as the crushing will be coarse.

At the cyanide plants of the Homestake Company the separation is made by a triple set of cones placed in series, the first set at the stamp mills and the other two sets at the cyanide mills. The first two sets are large flat cones, with no current except that induced by charging at the center and the overflow. The last set are smaller and deeper, and have a rising current introduced at the bottom as in the case of the regular hydraulic classifier. Aside from these the leaching vats are charged by Butters distributors, the overflow at the periphery of the vats going to waste, the Homestake plants only treating sands.

The pneumatic cyanide process has been introduced at the Pluma plant of the Horseshoe Company, where three 35-foot tanks are fitted with the pneumatic process, as an experiment. An air pressure of 4 to 5 pounds is put on after the vats are charged and air forced through the ore for 4 hours. Then leaching is commenced, the time on the pneumatic tanks in 72 hours, while on the other tanks the time is 120 hours. It is, however, questionable whether any benefit is derived from the pneumatic process for the Black Hills siliceous ores, for while the time is shortened, the extraction is not much increased, and difficulty is encountered in discharging tanks, owing to the network of pipes. The Hidden Fortune and the Hall-McConnell tailings plant will also use the pneumatic process. During the year some of the plants experimented with the Schilz barium dioxide process, but found it to possess no advantages for their ores. With the exception of the Homestake mills, which use zinc dust, all mills employ zinc shavings. The method of precipitating in barrels, or precipitation vats, instead of the compartment zinc box is finding much favor.

The new wet crushing plant of the Horseshoe Company, in course of erection at Terry, will have its rough crushing department separate from the mill, and above the stamps. There will be four No. 5 Gates crushers, and the crushed product from these will be conveyed to the main storage bins above the stamps by a belt conveyor 610 feet long. This conveyor runs the length of the bins, and is provided with a movable automatic discharge tripper to uniformly distribute the ore in the bins. These main bins have a capacity of 7,000 tons, while the ore-bin ahead of the crusher has a capacity of 1,000 tons. The mill is being

built in two sections of 120 stamps (500 tons) each. One section is to be completed before the other is begun. The stamps are 1,000 pounds weight, with a 6 to 7-inch drop. Double discharge mortars are to be used with a depth of issue of about 1 inch, crushing in cyanide solution through a 20-mesh woven wire screen. The pulp from the stamps is raised by two spiral sand pumps, with two extra ones to act as relays to 4 Klein classifiers, the height of lift being 20 feet. For each 500-ton section there will be 8 sand leaching vats 40 feet in diameter and 5 feet deep, 16 slime vats, 20 by 10 feet, 8 gold solution storage tanks, 15 by 10, and 8 sump tanks, 24 by 10 feet, and four solution storage tanks, 30 by 16 feet. There will also be two water tanks 35 by 16 feet. All tanks are of steel. It is the intention to completely treat the slimes in the vat they are originally charged into, sluicing out from that vat after treatment. The slimes will be agitated with air at 30 pounds pressure by a special arrangement of pipes. The sands, after leaching, will be discharged through four 18-inch bottom discharge gates on to belt conveyors. The scarcity of water does not permit of sluicing. It is estimated that the total water consumption of the plant will be 1 ton of water for every ton of ore treated. Precipitation will be carried on in zinc compartment boxes.

The new Penobscot Mill at Garden City, erected during 1902 and ready for operation, is a well designed mill, and an improvement on the older wet-crushing mills of the district. The mill is situated but a few hundred feet from the mine, with which it is connected by a covered way. A Blake crusher, size 13 by 24 inches, on a rock foundation, does the rough crushing. A Jeffrey elevator, capacity 40 tons per hour, takes the crushed product to the stamp supply-bins. At the discharge from the elevator an automatic conveyor cuts out 1-60 for the sampling room. The stamp supply-bins are flat bottomed, the ore sliding on its own cone to the gates, and have a capacity of 250 tons. Eight Challenge feeders charge the ore to the 40 stamps of 950 pounds weight, making a hundred 7-inch drops per minute. The shoes, dies, tappets and cams are of chrome steel. Single discharge mortar-boxes are used, with a low depth of issue. The ore is crushed with cyanide solution. The pulp from the stamps is raised by two Frier sand pumps 10 by 54-inch size to four cone classifiers, two in a series. The height of lift is 16 feet. The sands go to Butters & Mein distributors, ball-bearing, and having twelve 1½-inch pipe arms. The distributor is on a trolley above the vats and can be shifted to each one in turn. The solution and slimes overflow at the periphery of the vat over a ½-inch tongue of wood inserted into the staves. This device was first used by C. W. Merrill at the Homestake plants to secure a uniform overflow. This tongue or feather can be readily planed and the overflow kept perfectly level, which is necessary to prevent an uneven settling of the sands with slimes. The overflow from the sand vats is collected in an annular launder around the tank and can be conveyed to any slime vat in the mill by a 3-inch pipe discharge. There are six sand tanks, 30 by 6 feet, outside measurements; eight slime vats, 24 by 12 feet; two gold solution storage tanks, 20 by 10 feet; two sump tanks of the same size, and three stock solution tanks, 16 by 16 feet. All tanks are of Oregon fir. The siphoned solution from the slime vats is filtered in sand filters, 15 feet in diameter and 2½ feet deep, placed above the gold solution storage tanks. The sand leaching vats are discharged by sluicing through three 12-inch bottom discharge gates, by water furnished from a 50,000-gallon tank, with a pressure of 45 pounds. The slimes are pumped and agitated by two centrifugal pumps, lined with manganese steel. The precipitation is carried on in four 8-compartment boxes of steel, 20 feet long, each compartment being 2 by 2½ feet in cross section and 18 inches deep

to the filter. Before entering the compartment boxes the solutions will pass through 25 precipitating barrels. In all 400 cubic feet of zinc are available for precipitation.

The sand leaching vats are connected beneath the filters with a Rand vacuum pump, and a 3 by 10-foot vacuum tank. The precipitates are refined by sulphuric acid in a steel acid tank, 6 by 3 feet, which discharges in a vacuum steel filter tank, 3 feet in diameter, and situated over a wooden waste tank, 10 by 8 feet. The pumping of solutions and water in the mill is done by three Dean pumps, two of which are 4¾ by 5¼ by 5 inches, and the other 7½ by 6 by 6 inches.

The new cyanide mill of the Hidden Fortune Company is in course of erection a few miles below Deadwood on Whitewood Creek. As in the Horeshoe Mill at Terry the crushing department is separate from the mill. The crushing will be done by a 15 by 30-inch Blake, and the crushed product conveyed to the stamp-bins by a 24-inch belt-conveyor discharging by an automatic tripper into the bins, which have a capacity of 500 tons. The railroad bins above the mill have a capacity of 800 tons. Challenge feeders supply the 60 stamps, which are of 1,000 pounds weight, with 7-inch drops, 90 per minute. The capacity of the mill will be about 250 tons per day. The mortars will be double discharge, with a 1-inch depth of issue. Crushing will be done in cyanide solution. The pulp from the batteries will go to Butters & Mein distributors, placed over the sand leaching vats, in which overflow gates will carry off the slimes, to the slime vats. The pump is raised to the distributor by three Frenier spiral sand pumps. The leaching vats will be discharged by sluicing through six 15-inch bottom discharge gates. The five leaching vats are 40 by 6 feet. There are 4 sump tanks, 3 gold solution storage tanks, 2 stock solution tanks, 7 slime vats—in all, 21 tanks.

The new Gayville mill of the Homestake Company is similar to the Lead Mill described by the writer in THE ENGINEERING AND MINING JOURNAL of January 4, 1902.

LEAD IN 1902.

By JOSEPH STRUTHERS.

The production of lead from domestic ores in the United States during 1902 showed a decrease from that of the previous year, aggregating 267,521 short tons as compared with 279,922 short tons in 1901, which is equivalent to a decrease of 4.4 per cent. The subjoined table gives the preliminary report of the output for 1902, as compared with the revised figures for 1901, in short tons:

	1901.	1902.	Changes.	Per cent.
Desilverized lead.....	211,368	215,861	I. 4,493	2.1
Soft lead	57,898	74,363	I. 16,465	28.4
Antimonial lead	10,656	9,450	D. 1,206	11.3
Totals	279,922	299,674	I. 19,752	7.1

The silver-lead mines of the Coeur d'Alene region were actively worked throughout the year, and showed an increase in the total production, while the mines of the same class in Montana and Colorado were also active. The soft lead mines of southeastern Missouri showed a remarkable increase, the reported production for 1902 being 74,363 short tons, as compared with 57,898 tons in 1901. The production of antimonial or hard lead during 1902 was reported at 9,450 short tons (containing 2,517 short tons of antimony), as compared with 10,656 short tons (containing 2,235 short tons of antimony) in 1901. The lead refineries in the United States produced a very large quantity of lead from foreign ores and base bullion, the reported output for the year being 94,721 short tons. The greatest part of this material is derived from Mexico, the balance coming mainly from British Columbia.

The lead imported into the United States in all forms and foreign lead re-exported after being refined here in bond are reported by the Treasury Department for the eleven months ending November 30 as follows, in short tons:

	1901.	1902.	Changes.
Lead, metallic	595	2,329	I. 1,734
Lead in ores and base bullion..	105,328	94,487	D. 10,841
Total imports	105,923	96,816	D. 9,107
Re-exports	90,710	71,274	D. 19,436
Balance	15,213	25,542	I. 10,329

Of the imports in 1902 Mexico furnished 84,346 tons, or 87.1 per cent of the total, and Canada 8,566 tons, or 8.8 per cent.

THE LEAD MARKET IN 1902.

The year opened with the same quotations as ruled at the end of 1901, 3.85 to 3.95, St. Louis, and 3.95 to 4 cents, New York, but at the end of January, the American Smelting and Refining Company raised its prices 10 cents per 100 pounds all round, and also gave notice that in future orders for prompt shipment would be executed only at 2½ cents per 100 pounds extra. This was done in order to induce consumers and dealers to cover their requirements ahead and to carry part of the available supplies which had accumulated at the refining works. Consequently, quotations quickly advanced to 3.95 to 4.05, St. Louis, and 4.05 to 4.10, New York, and have ruled at these figures ever since, with but small variations.

It proved impossible to bring about the same high range of values as that of the previous year (the average for 1902 is about ¼ cent per pound lower than for 1901), owing to the danger of foreign lead being imported, even with a duty of 2½ cents per pound. This was due to the fact that the European markets have been very much depressed on account of bad business abroad and the constant fear of a deluge of exports from this side in the event of an advance.

While the consumption of lead in the United States has been very heavy—the demand for electrical purposes, cables, etc., especially, showing a large increase—and while the stocks existing at the end of 1901 have practically disappeared, it was necessary, in order to bring about the existing state of affairs, to take recourse to the same expedients as those of last year; to curtail the production of ores and export certain quantities of domestic lead to Europe. This, naturally entailed a heavy sacrifice, which, however, to a large degree, came out of the pockets of the ore producers, as they are being paid for their lead only on the basis of 3½ cents per pound. It is, furthermore, reported that in some cases royalties are being paid for quantities not mined, in order to pacify some of the recalcitrant miners.

There has also been a tendency on the part of the Trust to centralize the smelting of ores and the refining of lead bullion by closing down some plants and diverting material to others. Some of the steps taken will probably have a beneficial effect in the future, in spite of the inclination in some quarters to decry these efforts. But looking at the matter broadly, there are a good many which will tend to discourage mining and prospecting operations in a large number of camps, and in that respect they are certainly a detriment and setback to the industry in general. However, with the energy and enterprise characteristic of the American mining industry and the people therein engaged, there is no doubt but

Average Prices of Lead per Pound at New York.

Month.	1901.	1902.	Month.	1901.	1902.
January	4.350	4.000	July	4.350	4.075
February	4.350	4.075	August	4.350	4.075
March	4.350	4.075	September	4.350	4.075
April	4.350	4.075	October	4.350	4.075
May	4.350	4.075	November	4.350	4.075
June	4.350	4.075	December	4.153	4.075
Year	4.334	4.069			

what in the course of time, ways and means to a solution of this most difficult problem will be found.

The only producing center which benefited very largely by the continued high values is Missouri, where considerable strides forward have been made, resulting in a very heavy output.

The heavy decline in silver is very liable to affect production of low-grade silver-lead ores to a certain extent, especially if still lower prices for silver should be established—a fact which is feared in many quarters. During the present year the production was, however, probably larger than in 1901; and the mining and smelting industries, as far as silver-bearing lead ore was concerned, were quite prosperous.

THE COEUR D'ALENE DISTRICT DURING 1902.

The Coeur d'Alene District in Idaho shows an increase in production in 1902, notwithstanding the limitations of output imposed by the action of the American Smelting & Refining Company. Reports received from all producers show that the total output of the district was 75,200 short tons of lead and 3,569,263 ounces of silver. In 1901 the full output of the district was 68,953 short tons of lead, and 4,282,388 ounces of silver.

Largely owing to the limitation in output above referred to, comparatively little new work was done in the district beyond the ordinary prospecting and development work required to keep the mills supplied. In the Standard Mine the 800-foot level was opened, showing a continuous ore-shoot for 1,200 feet. A raise was out in from this up to 600 feet level, and sinking is now in progress down to 1,000 feet. The Hecla Mine was opened up on the 300-foot level, and stoping is now going on in an ore shoot which is blocked, however, about 600 feet. A connection is also being made from the 300-foot level to No. 3 tunnel. At the Tiger-Poorman Mine at Burke, the 1,700-foot level has been opened, and is showing in a very satisfactory way. Ore is being taken out from this level up to 800 feet. The Nordberg pump, which was placed last year on the 1,600-foot level, has proved itself to be a very economical machine. It is operated by electric motors, the current for which is supplied from water power located 1½ miles above the mine. There is also a compound condensing engine directly connected with the pump, which can be used to supplement the motors in case of low water at the power plant. The pump is made in two halves, either of which can be worked independently, and its total capacity is 1,500 gallons of water per minute, raised 1,500 feet vertically in a single lift. At the Wardner mine work was confined to the usual operations and developments, the latter being done chiefly on No. 2 tunnel 350 feet below the Sweeny Tunnel. The extraction of ore was confined to the stopes above the Sweeny level. It is a noteworthy fact that the Empire State-Idaho Company, which owns the two mines just referred to, has made arrangements under which the power for the mines—except that used for hoisting at Burke—will be furnished by electricity, generated by water power at Spokane Falls, Wash., and transmitted by wire over 100 miles to sub-stations near the properties. This arrangement, which is expected to be in operation by June next, is a notable development of the use of electricity in mining.

At the Bunker Hill & Sullivan mines near Wardner, the main work done during the year was the completion of the connection with the Kellogg Tunnel with the main stopes. Work has been in progress on this tunnel for several years. It is 12,000 feet long, and the portal is close to the company's concentrating mill. The output from the mine is now carried to the concentrators through this tunnel by tramways hauled by electric motors, and in consequence the company has discontinued the use of its great aerial wire rope tramway which was 2½ miles in length, passing directly over the town of Wardner. This tram-

way has been one of the show features of the camp for several years past.

As with most of the other mines in the district, no important additions were made to the mines or mills, the work being confined to sufficient development to supply the output delivered to the concentrators.

During the year 1902 the Silver King and Crown Point mines situated in the western part of the Coeur d'Alene District on the Bunker Hill & Sullivan lode, have been operated continuously by the Coeur d'Alene Development Company. During the first nine months of the year the operations were conducted on a restricted output, owing to inability to market the product, but during the last three months of the year the mines were worked to their full capacity. During the 12 months the mines produced about 6,920 tons of shipping product, consisting of crude ore and concentrates. The development work for the year consisted in extending the two compartments. Crown Point shaft 279 feet, and 2,645 feet of drifts and cross cuts in the two mines. No additions of any importance were made to the surface equipment during the year.

NICKEL IN 1902.

By JOSEPH STRUTHERS.

The chief step in the development of the nickel industry during the year was the organization of the International Nickel Company in April, which now practically controls the production of nickel in the United States and Canada. During 1902 there has been no production of metallic nickel from domestic ores as compared with 6,700 pounds in 1901; nor of cobalt oxide from domestic ores as compared with 13,360 pounds in 1901. The quantity of nickel refined in the United States from imported ores from Canada, New Caledonia and Norway aggregated 9,742,397 pounds, as compared with 8,664,614 pounds in 1901, while the quantity of cobalt oxide produced from foreign ores was 17,520 pounds, as compared with no reported production in 1901. The demand for nickel has continued active during the year, and the prices increased slightly in the closing months.

THE SUDBURY NICKEL MINES

By A. McCHARLES.

The chief event in connection with the Sudbury nickel mines in 1902 has been the transfer of the properties and business of the Canadian Copper Company to the International Nickel Company in the early part of the year. This new company is better known as the "Nickel Trust," but such a name is somewhat misleading, as it would naturally imply a combination of different companies and a practical monopoly of all the mines of the district. How erroneous such a conclusion would be may be seen from the plain facts of the case. So far as the Sudbury mines are concerned the so-called trust has simply taken the place of the old Canadian Copper Company, and nothing more. Then, besides the six mines owned by the Mond Nickel Company and the Lake Superior Power Company, there is also outside of the holdings of the trust quite a number of valuable nickel properties on the main or south range, such as the Murray, Worthington, Mount Nickel, Sultana and other mines, all well developed, and some of them worked more or less. No actual mining has been done anywhere on the recently discovered north range yet, but, including the Levack group, there are evidently a dozen or more workable ore bodies at various points along its total length of over 30 miles.

The usual capitalization of nickel companies in the Sudbury District heretofore has been from \$1,000,000 to \$3,000,000, and how the Interna-

tional Nickel Company, or trust, is to earn even a moderate dividend on \$36,000,000 of stock and bonds is a problem not easily figured out. A local explanation of the weather bears a little severely on this weak part of the scheme. The past season was the wettest ever seen in the district for fifteen years, and some of the old prospectors say that it must have been owing to the excessive amount of water in the capital stock of the trust.

On taking charge of the business of the Canadian Copper Company the first move of the new management was to close down most of the mines and works with the object, it was said, of remodeling the old plant and adopting a different process for treating the ore. But no changes of any kind have so far been made. Only two of the ten smelters were kept running through the summer months, but towards fall four more furnaces were gradually blown in, and work was resumed at three of the mines, though on a smaller scale than in 1901, and all in the same old way.

The Orford concentrating works at Copper Cliff were kept in constant operation throughout the year, making into high-grade matte the entire output of the smelters of the Canadian Copper Company. The Sudbury ores carry on an average over 20 per cent of sulphur, but only about half of it is expelled in roasting the ore in the open air. In the concentrating process nearly all the rest of the sulphur and most of the iron in the ordinary matte are eliminated, raising the final product to approximately 80 per cent in combined nickel and copper, sometimes in almost equal proportions, but generally with more nickel than copper, and in all the mines of the district the ratio of the two metals in the ore is perhaps as two to one. Only an occasional mine, like the good old Copper Cliff, is found to be higher in copper than in nickel, and there is comparatively very little copper in the ore deposits of the north range. A mine may be high in nickel and low in copper, but never high in copper and low in nickel. The gold and platinum in the ores runs from 50 cents to \$1 to the ton. The gold is associated with the chalcopyrite or copper ore, and the platinum with the pyrrhotite or nickel ore.

The Mond Nickel Company made steady progress during the year. The Victoria Mine in Denison, owned and worked by this company, has been exploited to below the 500-foot level in a very large and massive body of good paying ore. At the company's works near the mine the common matte from the smelting furnace is all bessemerized before being exported to the Mond nickel refinery in Wales. This company also bonded the North Star Mine in the spring, and had a small force developing it through the summer by an open cut in a peculiar chimney of high grade ore. Some of the experts who have visited the Sudbury District advanced the theory that the present mines, cropping out on the surface in hills and ridges, are merely chimneys of ore leading to a continuous, unbroken mineral bed at lower depths than has yet been attained in any of the mines, and especially the series of contact deposits that occur at the junction of the granite and the diorite along the main nickel range for 25 miles. But in all the mines so far worked there does not appear to be any connection between the ore bodies even when in close proximity to each other. In some cases in the same group of contiguous properties one mine may be high-grade ore and the next one to it low grade.

The Lake Superior Power Company had a busy year working two mines, the Gertrude and the Elsie, and erecting a smelting plant at the former and a rock house at the latter. The first furnace installed in the works was started about midsummer, and a second furnace was added in the fall under the same roof. The ore already on the roast heaps will keep both going night

and day for at least six months. This company also tested with a diamond drill a third property at Blue Lake on the east end of the north range, and with very satisfactory results. The ore body occurs in the crater of an extinct volcano, and carries a remarkably high percentage of nickel from the grass, or rather moss, roots.

The magnetic needle has lately come into use in prospecting for mines on the nickel belt. The Edison party of about 20 students and others did a great deal of tramping the past two seasons, mostly on the main range, trying to locate hidden invisible ore bodies in this way. A rival party of Cornell students also put in their holidays last year at the same work. They both claim to have found what is called high "readings" in several places, and took up in consequence many parcels of mineral lands. Whether they have found any mines or not remains to be proved by a vast amount of development work, but judging by their looks on coming back in the fall, there is no doubt of their having found even a much better thing, namely, the robust health and vigor that are invariably to be had in camping out in the bush.

To sum up the whole work of the past year in the Sudbury mines, the output of ore was considerably less than in 1901, and the nickel industry seems to have been in a sort of transition state. It is confidently expected, however, that next season will be marked by renewed activity and progress in mining, and many changes in other important respects. Several new processes for both smelting and refining these nickel ores have been tried at some of the mines from time to time, but ruinous failure was the end of them all. After thirteen years of such experimenting the old system of heap-roasting and smelting into matte still obtains at the works of all the companies in the district. There has hitherto been no nickel metallurgy, but only copper metallurgy in the treatment of the Sudbury ores, which is rather a strange fact. An attempt at pyritic smelting has recently been made by one of the companies on quite a large scale, but with what results is not publicly known yet.

The anthracite coal strike has affected even the remotest portions of the American continent, and the mining companies of the Sudbury District, who had been using coal instead of wood for some years, had to go back to the use of wood again this fall. Fortunately, there is no lack of timber for fuel, and all other purposes within easy reach of the mines.

The great fall in the stock of the Lake Superior Power Company in December caused the Elsie Mine to be closed down for the winter, and the proposed bessemerizing works are not to be erected until the financial affairs of the company are put into a better state. But all operations at the Gertrude Mine are still going on as before, and the smelter has already turned out over \$200,000 worth of nickel-copper matte.

Mr. Francis H. Clergue is certainly a wonder promoter, and may perhaps be a little too optimistic about some of his schemes. He has done at least one valuable service to Ontario by directing public attention to the great undeveloped resources of the new northern districts of the province. His mistake was in not paying sufficient regard to the old maxim as to the danger of having too many irons in the fire at the same time.

The mines and works of the Mond Nickel Company were also closed down in December for a few weeks in order to make the necessary alterations in the smelting furnace for treating the ore in a slightly different way.

The concentrating plant of the Ontario Smelting Company at Copper Cliff is being enlarged to double its previous capacity, and the new buildings for this purpose are in course of erection now.

The affairs of the Nickel-Copper Company, of Hamilton, Ont., are still in the same chaotic state, above referred to.

MINING IN NEW CALEDONIA IN 1902.

By F. DANVERS POWER.

The railway up the west coast from Noumea, under construction by the Government, has been finished as far as Dumbea. This line is intended to assist the mining and agricultural interests, for the passenger traffic is not sufficient to make it pay, but it is very doubtful, situated as New Caledonia is, whether it will be a success.

The mining in this colony is now confined to nickel, cobalt and chrome. The copper mines at the north of the island were abandoned at the beginning of the year.

Nickel.—Though this metal has come down somewhat in price, still so far the miners in New Caledonia have not felt the effects, as a reduction in home freights permit the buyers to pay the old prices; in fact, recent contracts have been made on advanced rates. The principal producer of nickel is still the Societe le Nickel, a French company, with a capital of \$2,000,000, divided into 40,000 shares of \$50 each. Last year the company distributed a dividend of 9 per cent. The great event of the year was the advent of the International Nickel Company, which has secured large interests in New Caledonia. This American corporation, with a capital of \$24,000,000, was floated with the object of controlling a large portion of the world's output of nickel, and outside its Canadian mines, has purchased the business and properties of La Societe Miniere Caledonienne, and has a controlling interest in the Nickel Corporation of London. The idea of the International Nickel Company is to erect works for the treatment of the New Caledonian ores, either in Australia or New Caledonia so as to enable them to deal with ores of a grade that would otherwise be too low to ship to Europe or to America. In New Caledonia the inhabitants are very keen on having the works erected there, but this is hardly likely to be done, for in spite of certain concessions which look better on paper than they are in reality, there are many objections; for suitable labor would have to be imported, likewise the fuel and machinery; the local fluxes are scattered and limited, and there is no central place for the works which would suit mines that are so spread over various parts of the colony, whereas to erect two or more smaller plants would prove an expensive mistake. Everything points to New South Wales as being the most suitable country in which to erect the works. There are good shipping facilities, fuel is abundant, also fluxes and labor, and there are large foundries in that State. The most likely sites are at Port Kembla on the south coast, and Newcastle on the north coast. Both places can be reached by rail from various parts of the country, but the former has the advantage of deeper water, and the district produces coal which is better for coking purposes.

Cobalt.—At the end of last year and the beginning of this the price of cobalt ore containing 4 per cent cobalt protoxide in New Caledonia was forced up higher than circumstances warranted. For a long time the price in Europe did not justify more than 90 francs per ton being paid for this quality of ore at the mines, but the price steadily rose to 330 francs, until recently, since which it has receded. This unsteadiness cannot be accounted for either by the falling off of the production, or by an increased demand for cobalt. It was due to an insane competition between the various buyers in New Caledonia, which showed a lack of the sense of responsibility on behalf of some of those who had the handling of other people's money, for all the operators must have had heavy losses in connection with their transactions, the prices paid in Europe not being sufficient to recoup them. Underlying all this was apparently an attempt to drive some of the buyers out of the market, but as the principal competitors were too well matched, they have agreed to cease this cut-throat practice, so the price at the mines has accordingly fallen. The inflated prices naturally caused unusual activity in cobalt mining.

Chrome.—At Baie N'go where the greater bulk of the New Caledonian chrome ore has been won of late years, some of the mines have been closed down on account of the poorness of the ore, and the production of the remaining mines has been considerably reduced. One or two mines have been recently opened up at Nehoue in the Gomen District, on the northwest coast, from which good results are expected, and an important contract has been made in Europe, relying on the produce from these mines. There is talk of a combination of chrome interests among important chrome mine owners. One of the parties concerned is at present in Europe, and a company is supposed to have been formed in Paris. Great hopes are expressed in New Caledonia with regard to this combination, and an increased output of this ore is looked forward to in the near future. The mines in question are far in the interior, which will make transport comparatively expensive.

PLATINUM IN 1902.

By JOSEPH STRUTHERS.

The production of platinum in the world ranges annually between 160,000 and 170,000 troy ounces, supplied chiefly from Russia, the balance coming mainly from Colombia, South America. Unfortunately in the latter country the revolutions which have been prevalent in recent years have seriously hindered the development of this important industry. The uses of the metal would be largely increased if it could be obtained in sufficiently large quantity to lower the price. Unfortunately, for many purposes there is no metal to take its place, and the limited supply maintains the price almost equal to that of gold. Russia supplies about 90 per cent of the entire output of platinum in the world.

The production of platinum in the United States from domestic ores during 1902 amounted to 358 troy ounces, as compared with 1,408 ounces in 1901. In addition to the production from domestic ores there were produced in 1902 from South American ores 674 ounces of metal. In connection with the production of platinum from domestic ores during 1902 there were also obtained 20 ounces of iridium as compared with 253 ounces in 1901. These metals are so closely allied in their properties that doubtless the reported production of platinum in early years included from 15 to 25 per cent of iridium.

In the United States the chief sources of the domestic supply of platinum are the gold placer deposits in Trinity and Shasta counties, California, from which the metal is obtained as a secondary product. Platinum also occurs in many other gold placers of the Pacific Coast States, and it has been reported in Alaska; these deposits, however, have not been sufficient rich to permit of the profitable extraction of the metal. A new occurrence of the metal has been reported in Porto Rico, where it is found in the auriferous sands of the Corozal River. There has been little if any development during the year in the treatment of the platinum arsenide mineral, Sperrylite, at the Rambler Mine, near Encampment, Wyoming. Platinum is obtained from the gold placers in British Columbia, but the quantity is insignificant. The metal also occurs in the nickel ores of the Sudbury District, Ontario, Canada, and efforts have been made during recent years to extract this important metal, but so far without success.

The price of platinum in large lots in New York at the close of the year was \$19 per troy ounce. The metal as manufactured into chemical ware or wire was quoted in New York at 72½ cents per grain.

The imports of platinum for the eleven months ending November, 1902, amounted to 6,467 pounds, valued at \$1,766,869, as compared with 5,707 pounds, valued at \$1,540,351, in the corresponding eleven months of 1901.

QUICKSILVER IN 1902.

By JOSEPH STRUTHERS.

It has not been practicable to obtain complete reports from all of the producers of quicksilver, yet from reliable sources estimates have been prepared which indicate that the production of quicksilver in the United States during 1902 will closely approximate 32,000 flasks of 76½ pounds each, which is an increase of 2,273 flasks above the output of 29,727 flasks in 1901. California produces the bulk of the output and is credited with 27,500 flasks, a slight increase above the output for 1901. Texas contributed the balance, 4,500 flasks, which is an increase of 54 per cent above the production of 2,932 flasks in 1901. The principal producers in this State are the Marfa & Mariposa Mining Company, operating two 10-ton Scott furnaces, and the Terlingua Mining Company (formerly Lindheim & Dewees), operating a 50-ton Scott furnace. Oregon, which reported 75 flasks in 1901, made no production during 1902, the quicksilver mining operations being limited to development work only.

The average monthly prices of quicksilver at New York and San Francisco during 1902 are given in the subjoined table:

	N. Y.	S. Franc.		N. Y.	S. Franc.
Jan.	\$48.37	\$46.44	July ...	\$48.00	\$46.00
Feb.	48.00	47.75	Aug.	48.00	46.00
March ...	48.00	47.75	Sept. ...	48.00	46.00
April	48.00	47.75	Oct.	48.00	46.00
May	48.00	46.40	Nov.	48.00	46.00
June	48.00	46.00	Dec.	48.00	46.00
			Average .	\$48.03	\$46.51

Foreign Countries.—There has been a very large increase in the production of quicksilver in Spain during 1902, the reports showing an output of approximately 1,500 metric tons, which is nearly double the production of 754 metric tons in 1901. The mines at Almaden alone report a production of 1,440 metric tons. In Austria the Government quicksilver mines at Idria, which have been operated upwards of 300 years, employ regularly about 1,200 men. During 1902 the production is reported at 500 metric tons as compared with 525 metric tons in 1901. In Italy the smelting works at Siele, Cornacchino, Abbadia, San Salvatore, Montebuono and Cortevicchia produced approximately 250 metric tons of quicksilver during 1902, a small decrease from the production in 1901, which amounted to 278 metric tons. The Cermak-Spirek furnaces and condensers, which are especially adapted to the treatment of low-grade quicksilver ores (about 0.5 per cent Hg.), have been used quite successfully at these works.

TIN IN 1902.

In one respect the tin report for 1902 shows no change from the previous year. The United States produced no tin during the year. There have been reports of extensive discoveries of deposits of alluvial tin in Alaska, and there seems to be no doubt that such deposits exist in the district along the coast to the northeast of Cape Nome, and elsewhere, but the region is an extremely difficult one to explore, and it is impossible to determine from such accounts, as have been received, the actual value of these discoveries. An attempt to revive the prospecting for tin in Southern California seems to have met with very little success.

The supply of tin for the United States, which is the largest consumer of that metal in the world, has been drawn during the year entirely from abroad, as heretofore. Our chief source of supply continues to be Straits tin from the Malay Peninsula, about 60 per cent coming to this country direct, the remainder reaching us through Great Britain. Our receipts from Australia remain comparatively small, as do those of Banka and Billiton tin, which comes to this country almost entirely by way of Holland. Imports have been large this year, the total for the 11 months ending with November, having been 34,876 long tons—an increase of 4,500 tons, or 129 per cent over last year. Of the exports this

year, 78,403 tons came from the Straits direct, 14,633 tons—chiefly Straits tin—from Great Britain 1,429 tons—Banka and Billiton—from Holland; 262 tons from Australia, while 551 tons were miscellaneous. Thus fully 90 per cent of our consumption was Straits tin.

The increase in the consumption of tin in this country during the past few years has been large. This is due to the growth of the manufacture of tin-plates, which has developed into a large and important industry.

The world's production of tin comes largely from countries in which no accurate mining statistics are kept, and estimates must therefore be based entirely upon the commercial movement of the metal. The statement given below, which covers the year 1902, the closing month being estimated, is based upon the facts collected by the Metallgesellschaft, of Frankfurt, by Messrs. Ricard & Freiwald, of Amsterdam, and by Sargeant & Co., of London. They are believed to show, with a very close approach to accuracy, the production and consumption of tin during the year. The total production of tin in the world in 1902 is estimated at 91,500 tons, an increase of 2,420 tons over 1901. Of this approximately 53,750 tons, or nearly three-fifths, was from the Malay Peninsula, classed as Straits tin; 19,500 tons from the Dutch East Indies; 3,250 tons from Australia; 9,500 tons from Bolivia, and the balance chiefly from the English mines, with a little from Mexico and other countries.

The only uncertain element in this statement is the difficulty of tracing certain small shipments through British and Dutch ports to the minor European countries, and to South America. It will be seen that the United States is still the largest consumer of the metal, absorbing nearly 60 per cent of the total production.

The consumption of tin continues very close to the production; in fact, what are known as the visible supplies of tin, that is, those actually in warehouse and afloat, on December 1 amounted to 18,346 tons, which was a decrease of 48 tons from the corresponding date in 1901. The production, however, has shown some increase, and the condition of affairs which existed for two or three years, when the output fell somewhat below the demand, has passed for the present.

In addition to the quantity shown above, there is a considerable production in China, the exact amount of which it is impossible to ascertain. Prof. Henry Louis some years ago estimated this as high as from 15,000 to 20,000 tons yearly, but it seems quite probable that this is too high a figure, and other authorities do not put the quantity at more than 10,000 tons. This production has been heretofore almost entirely consumed within the Chinese Empire itself, but it is to be noticed that last year offers of Chinese tin from the province of Yun-Nan were made in London, and from 2,500 to 3,000 tons were sold at a price ruling somewhat under that for Straits or Australian tin.

The production of tin in Bolivia, some notes on which are given below, has not shown any considerable increase. Although it seems probable from the present condition of the industry that there will be an improvement in the year which has just opened. Nearly all this tin, which is exported in the form of barilla or black tin, goes to London.

The Straits production showed a considerable gain last year, chiefly owing to the more abundant supply of labor. The troubles in China, which seemed to have cut off for the time the emigration of laborers from that country, have subsided so far that there was no difficulty last year in obtaining the miners and coolies needed for the industry. It is, as we have heretofore noted, a curious fact that fully 90 per cent of the tin mined in the world, is by Chinese labor. In the Malay Peninsula, however, a gradual change is going on in the industry which is passing into the hands of large companies. These companies are gradually obtaining control of the tin deposits, and are working them directly. The number of small producers who operate on their own account, and sell the tin ore obtained to the

smelting companies, is becoming less year by year.

Nothing has been done during the year towards exploring or developing the deposits of tin ores which are said to exist in some portions of the Philippine Islands. With the pacification of the Islands, and the adjustment of the mining laws, it seems quite probable that work in this direction will be undertaken before long.

THE NEW YORK TIN MARKET IN 1902.

The average price of tin in New York for 1902 is somewhat higher than for 1901, due to the article being in an exceptionally strong position in the relation of supply and demand. Shipments from the East have been normal, while consumption in Europe and especially in the United States was very large. Heavy inroads seem to have been made on the available supply of Banka tin. Strange to say, as yet no tin has been profitably mined in the United States. Fair quantities of Bolivian tin are now being shipped, but sold at a discount, owing to inferior quality.

Speculation again had full sway on both sides of the Atlantic, and prices showed wide fluctuations. Futures were selling at a discount practically throughout the year, same at times amounting to as much as 1 cent per pound, and it was not until the latter part of December that the backwardation disappeared.

The year opened rather dull, with spot tin selling at 22¾, but as January progressed the market developed considerable strength, as high as 24½ being paid. Toward the end of the month a reaction set in, only to be followed by another upward movement, which assumed very large proportions. There was an exceedingly brisk demand, business in all lines being very satisfactory indeed, and prices advanced from month to month, culminating in a quotation of 30 cents at the beginning of June.

The lower cables from abroad and free offerings from the East caused quotations in July to decline, but spot tin remained scarce throughout the summer, all metal being forwarded direct from the steamers to the interior for consumption there.

Month.	1901.	1902.	Month.	1901.	1902.
January	26.51	23.54	July	27.85	28.38
February	26.68	24.07	August	26.78	28.23
March	26.03	26.32	September	25.31	26.60
April	25.93	27.77	October	26.62	26.07
May	27.12	29.85	November	26.67	25.68
June	28.60	29.36	December	24.36	25.68
			Year	26.54	26.79

Bear sales in London and rumors regarding a strike at the mills of the American Tin Plate Company, which broke out later on, caused a further drop during August, and in September as low as 25¾ cents was accepted.

Owing to a somewhat better demand prices advanced again during October to 26 cents, the demand being stimulated by a cut in the price of tin plates and the settlement of the strike.

Toward the end of November the decline in the silver market commenced to play havoc with tin, and continued to exercise a depressing influence for several weeks, consumers becoming afraid of the article and covering only their immediate wants. At one time the market ruled as low as 25 cents. At this figure, however, the trade evidently thought it safe to take hold of the article again, and large orders were placed for prompt as well as future delivery.

The year closes with spot tin selling at 26¾; futures at about the same price.

TIN DEPOSITS OF THE YORK REGION ALASKA.

By EDGAR RICKARD.

The York Region is situated in the northwestern portion of the Seward Peninsula, Alaska Territory. It covers an area of about 120 square miles, the outline forming a rough isosceles triangle with Cape Prince of Wales as the apex, one leg along the shore line of Behring Sea and

the other on the Arctic Ocean. The base of the triangle lies 14 miles inland, and has a north and south course. The port of call for the district is York, a small settlement of a few huts at the mouth of the Akanovik River on Behring Sea. The port of York is an open roadstead, like Nome, and only available for a period not exceeding four months in the year. It would be impossible to land a heavy cargo in a storm, and it is difficult to do so in the best of weather.

The presence of stream tin in this district was first brought to public notice in 1900 by the United States Geological Survey reconnaissance of the Seward Peninsula, of which Alfred H. Brooks was in charge.

Although many of the streams which empty into Behring Sea show traces of tin the only deposits of consequence, as yet discovered, are to be found in the creeks and gulches which have their source in a range of prominent hills, 1,000 to 1,300 feet high, on the Arctic slope of the peninsula. The range is about 3 miles long, and extends nearly north and south. The highest and most prominent point is Cone Hill, which lies about 8 miles due east by north from Cape Prince of Wales.

Geology.—The range itself and the bedrock of the streams are all of slate. The sides of the hills are deeply covered with shattered fragments, due to the action of frost. The most northerly peak of the range shows quartzite, in place, at the summit, and the discovery of one or two pieces of this rock on other portions of the range indicates that probably the slate lies upon quartzite. The wash in the streams shows no quartzite, but is made up of slate, with a small proportion of quartz. Some of the slate fragments in the wash show iron pyrite. No ledges or veins of consequence were found. The presence of enormous quantities of slide rock on the sides of the hills made it impossible to examine any of the rock in place, except at the extreme summits.

The tin is found as cassiterite (oxide of tin) irregularly distributed upon, or very near, the bedrock of small modern streams rising in the range of hills above described. The source of the cassiterite can be readily traced to the slate of the range, where it undoubtedly occurs in countless small veins and vughs, sometimes associated with quartz, and so thoroughly scattered throughout the mass that the action of the elements has washed it from the hillsides and concentrated it in the streams below in appreciable deposits. A slide on the hillside at the head of Expansion Gulch has exposed a good section of the slide-rock. Careful panning tests made in this cut show a trace of cassiterite, a further indication of the source of the stream deposits. The cassiterite, affording as it does such unusual resistance to the natural agencies of decomposition, has greatly assisted in the action of concentration.

The smaller pieces of cassiterite found in the wash have sharp edges, and show little action by the water. Many specimens were collected, which are almost perfect crystals with the pyramidal terminations and short twin forms easily distinguishable. The larger pieces are water-worn. I believe the perfect crystallization of the smaller pieces is due to the protection they received from the encasing slate fragments in which they were carried into the creek beds, the softer encasing rock being first eroded away by the stream. Pieces of slate and quartz were picked up in the streams, showing small crystals of cassiterite covering a broken face or in little seams of the rock running across the natural cleavage plane of the latter.

The occurrence of cassiterite in slate is of unusual interest, as there is no record of its discovery in any locality in any other formation than a granite or closely allied rock.

Economic Conditions.—All of the creeks and

gulches have been well covered with locations. The claims are 660 feet in width, but the wash carrying the cassiterite is limited to the flood-plains of the modern streams which are narrow and confined between benches of tundra,* averaging in width from a narrow gutter of a few feet to a maximum width of 100 feet. The richest section was found on Tillery Creek, above its junction with Buck. Here the wash does not average over 16 inches in depth, and only carries 8 pounds of 60 per cent cassiterite to the cubic yard. Cuts run into the tundra benches on the sides near the richest wash failed to show that the values continued in that direction. Frozen ground was encountered in extending these cuts. The wash was tested by sinking holes to bedrock at intervals across the bed of the stream and panning weighed samples from each place. Sluicing tests on larger quantities were also made on some of the richer wash of Tillery Creek. In these sluicing tests an attempt was made by adjusting the conditions, to determine as nearly as possible what would be the cost of working the wash in actual practice. The pick and shovel work, the wages and class of labor were as nearly as possible the same as would obtain in the removal of the wash on a commercial scale. The results prove that it would not be safe to estimate more than 3-1-3 cubic yards per man per day, or \$2.10 per cubic yard, an equivalent of 21 pounds of tinstone at 10 cents, which was the estimated net value of 60 per cent cassiterite, after deducting from the market-price of tin the freight, treatment charges, and loss in reduction. There is therefore no measurable extent of ground on any of these creeks which would pay for the labor of handling it.

The most interesting feature of these deposits lies in the fact that they indicate that we may look for tin in other than granite formations, but it must be exceedingly rich to be profitable in such a distant and inaccessible district as the York Region.

NOTES ON TIN MINING IN BOLIVIA.

By J. B. MINCHIN.

The Bolivian tin deposits are found scattered at intervals over a tract of country comprising the mountain ranges along the eastern edge of the great tableland, and which extends some 300 miles from north to south by, say, 20 from east to west.

The more important deposits at present known are those of Huaina Potosi and Quimsa-Crur in the department of La Paz, of Colqueri, Negro Pabellon, Morococala, Huanuni, Anteguera and Avicaya in the department of Oruro; of Llallagua, Uncia, Potosi and Chorolque in the Department of Potosi.

The lodes, dipping usually at angles of from 50° to 70°, are almost invariably met with traversing highly inclined metamorphic shales, and occasionally passing into the adjacent igneous rocks. They are generally at altitudes of from 13,000 to 15,000 feet above sea-level. Sometimes, as at Quimsa-Crur and Chorolque, running still higher. At Avicaya and Uncia the rocks are polished and grooved on the surface by ancient glacier action.

The climatic conditions of the Bolivian tableland must have undergone a great change. The old water-mark, a calcareous deposit on the hill sides, shows that a vast sheet of water formerly existed, covering more than 20,000 square miles. This has dried up in the course of ages, nothing now remaining but the lakes of Titicaca and Poopo.

The conditions of the tin deposits vary greatly, as regards width; every gradation is encountered from the narrowest veins up to lodes of two and three meters. These lodes usually carry streaks of more or less pure tin ore, the rest of the lode matter being composed of compounds of silica and alumina, and of iron oxide with tin ore intermingled. In some cases the lodes are

* Tundra is the frozen marsh of the Arctic regions.

filled with soft clay carrying a large percentage of tin oxide in the form of grains and nodules, and occasionally rich pockets are found in which the whole lode is filled with nearly pure tin ore as a coarse sand. In these cases it is, of course, mined with great ease, but, as a general rule, the lode-matter is solid, and the country rock unusually hard.

Little or no progress was formerly possible in this industry, chiefly on account of the great difficulties of transport, more especially of machinery, but during recent years more attention has been paid to it, owing to the comparative facilities offered by the Antofagasta-Oruro Railroad, and to the present favorable price of the metal. Improved grinding and concentrating machinery is in operation or in course of erection for various enterprises.

The concentration mills are usually at altitudes of from 12,000 to 13,000 feet above sea level, or from 1,000 to 2,000 feet below the mines. Until recently the transport of ores to these mills was carried on exclusively by means of llamas and donkeys, and constituted one of the miners' chief difficulties, owing to the insufficient number of animals available, and the considerable cost, amounting to \$1.25 per ton-mile. The Avicaya, Huanuni and Chorolque enterprises have lately put up ropeways for carrying their ores. These lines, supplied by the Ropeways Syndicate of London, are giving great satisfaction. They have each a capacity of 8 tons per hour, and work by gravity, the cost of transport being reduced to about 12 cents per ton-mile. The most important of the lines is that at Avicaya with an approximate length of 3 kilometers.

The fuel question is another difficulty here, as no coal exists on the Bolivian plateau and the imported article from England, the United States or Australia costs \$30 per ton. Native fuel, "yareta," or llama dung, is efficient for steaming, and is comparatively cheap, but in many districts it is becoming scarce.

At the amalgamation works belonging to Senor Avelino Aramayo at Bella Vista-Poopo, a Deutz anthracite suction gas motor was recently erected, of 80 horse-power at sea level. Brake trials at Poopo gave from 50 to 55 horse-power, a result considered satisfactory, in view of the altitude of 12,300 feet. The consumption of anthracite was 0.7 kilograms per horse-power hour, but it is expected that this will be reduced to 0.6 kilograms. Similar motors are in course of erection for the Avicaya and Huanuni enterprises, which will then be enabled to run their concentration plants with regularity. Petroleum motors are employed at Avicaya for electric lighting and for running Wilfley tables.

The average contents of the ores in Huanuni and Avicaya, as they come from the mines, is from 10 to 12 per cent of metallic tin. The degree of fineness to which they are ground depends on their quality. They are pulverized as little as possible, so as to avoid the formation of slimes. At Avicaya No. 4 to No. 8 sieves are employed in the stamps and ball mills, while at Huanuni, owing to the tin oxide being more disseminated through the gangue, a 25-mesh is necessary in the batteries.

The ground ore passes through hydraulic separators, which, with an upward current of water, carry off the slimes to settling tanks, whence they are treated in round buddles and Wilfley tables, while the coarser material is classified in trommels and concentrated in automatic jigs. The concentrates undergo a final treatment by washing in Sieves, after which they are dried and sacked for export. At Avicaya the average ley of the finished product, or "barrilla," is over 70 per cent of fine tin; while at Huanuni, in spite of the finer grinding, it does not usually exceed 67 per cent. The Huanuni tailings still contain 2 per cent of tin, and though they admit of good concentration to 10 per cent the tin oxide cannot be separated without further pulverizing.

Huntington mills have been ordered for this purpose.

The Llallagua-Uncia mines occupy another important tin region, but as they have been more recently opened up and are about 45 miles distant from the railroad, with which they are not yet connected by a coal road, the ores are still treated in a primitive manner, being ground under hand-worked rockers and concentrated in simple buddles.

The Potosi production is so far chiefly derived from the old silver amalgamation tailings, which are roughly concentrated, and then reduced with charcoal in small water-jacket furnaces and run into bars for export, on account of the higher freight from this district.

The Quimsa-Crur region appears to be promising, though it has as yet been but little investigated, owing to its distance from the railroad, to bad roads, scarcity of labor and the great elevation at which the lodes exist. Many of them are about the perpetual snow line. This has, however, the great advantage of affording ample water supply for power purposes.

The rich mines belonging to Senor Aramayo in the great Chorolque Mountain, near the southern extremity of the tin belt, are some 80 miles from the Antofagasta Railroad, and at an elevation of 17,000 feet above sea level, the concentration mill itself being nearly 16,000 feet.

In addition to the tin mines proper, many of the silver ores, as in the case of the Oruro mines, contain a small percentage—2 to 4 per cent—of tin, which is, however, advantageously extracted by the inexpensive concentration of the lixiviation tailings.

The depth to which the tin ores extend in the Bolivian mines has not yet been clearly established. Some of the principal lodes in Huanuni and Avicaya are still rich at 300 to 400 meters below the outcrops. In other cases there appears to be a tendency for the value to fall off in depth, the tin ore being replaced by more or less poor iron pyrite.

Reliable statistics of Bolivian tin production are not readily obtainable. That of the principal enterprises may, however, be very approximately given as follows, in tons per month, of black tin ("barrilla"):

Huanuni Tin Mining Company, Huanuni.....	65
Teller Hermanos, Huanuni.....	60
Other mines, Huanuni.....	75
J. Juleff, Anteguera.....	50
Totoral Mining Company.....	65
Avicaya.....	100
Llallagua.....	45
Compania Minera Uncia, Uncia.....	35
S. Patiño, Uncia.....	80
Chorolque.....	90
Silver ore tailings, Oruro.....	130
Total tons.....	795
Equivalent to metallic tin, tons.....	525

To this may be added a monthly production in bar tin from the Potosi mines, 135 tons, making a total of 660 tons monthly.

Estimating the production from all the smaller workings, including some stream tin, as equivalent to 140 tons monthly of bar tin, we obtain a total production for the whole Republic of 800 tons, or, say, 9,600 tons yearly.

ZINC IN 1902.

By JOSEPH STRUTHERS.

The production of metallic zinc or spelter in the United States during 1902, amounted to 158,447 short tons, which is the highest on record and nearly more than double that in 1896. The production in 1901 was 140,822 short tons, which shows an increase for 1902 of 17,625 tons, or 12½ per cent. For comparison the subjoined table shows the production of spelter by districts:

	1901.	1902.	Change.	Per cent.
Illinois and Indiana.....	44,896	47,182	I. 2,286	5.
Kansas and Missouri.....	87,353	98,362	I. 11,009	12.6
South and East (inc. Wis.).....	8,603	12,903	I. 4,300	50.0
Totals.....	140,852	158,447	I. 17,595	12.5

In the Eastern and Southern works there has

been a considerable increase in the production, particularly if in addition the output of zinc-oxide be taken into consideration. Missouri and Kansas show the largest increase, while in Illinois and Indiana the increase is less marked, due to the gradual removal of smelters to Kansas, where natural gas can be utilized to commercial advantage. The Eastern works have obtained their supply of ores from the mines of New Jersey and southwestern Virginia, while the mines of the Joplin region have furnished ore for the majority of the Western works. The full details in the progress in mining and smelting zinc ores will be found in the reviews given later in this section.

The exports of spelter from the United States for the eleven months ending November, 1902, amounted to 3,198 short tons, or 9.8 per cent, increase above the exports of 2,915 short tons for the same period in 1901.

The production of zinc oxide (zinc-white) has increased to some extent, being 47,821 short tons for 1902, as compared with 46,500 short tons in 1901, an increase of 2.8 per cent; nearly all of this product is made at the works of the New Jersey Zinc Company. The exports of zinc oxide for the first eleven months of 1902 amounted to 4,961 short tons, as compared with 4,253 short tons in 1901, an increase of 14.3 per cent. The foreign demand for United States zinc ores has continued to increase, the exports for the eleven months ending November, 1902, amounted to 45,047 short tons, as compared with 34,392 short tons in 1901, an increase of 30.9 per cent last year.

THE SPELTER MARKET IN 1902.

The year under review was a fairly prosperous one for the zinc industry of the country, home consumers absorbing practically all the metal that was produced, in spite of a heavy production, and it was not until the very end of the year that some stocks began to accumulate. Under these circumstances, it was not necessary to export spelter in order to keep up prices at home, as has been the case in former years. The higher prices of fuel and labor tended to somewhat raise the cost of production.

Galvanizers, brass mills and sheet zinc manufacturers have all been very busy, and increasing quantities were again used for electrical purposes. The paint and oxide business was also satisfactory.

One or two new smelting works were erected in the Iola Gas Belt, some of the older ones enlarged, and several smaller ones consolidated, thus creating a number of strong concerns. The result was an introduction of new business methods, which in the course of time will no doubt have beneficial results.

Larger quantities of ore are being shipped every year from Colorado and British Columbia—a plant being at present built in Colorado to treat the former—and it is evident to the intelligent observer that the newly found prosperity will come to an early end if new outlets cannot be found for an increased production. This fact has been recognized by the smelters, who have given the matter much thought. It will for the present probably result in a larger output of sheet zinc, the use of which in this country is not nearly as large as it is in Europe.

Average Prices of Spelter per Pound at New York.

Month.	1901.	1902.	Month.	1901.	1902.
January	4.13	4.27	July	5.95	5.27
February	4.01	4.15	August	5.90	5.44
March	3.91	4.28	September	4.08	5.40
April	3.98	4.37	October	4.23	5.38
May	4.04	4.47	November	4.29	5.18
June	3.99	4.96	December	4.31	4.78
			Year	4.07	4.84

The year opened with the market rather dull and somewhat irregular. The ruling quotations were 4.12½ to 4.17½, St. Louis; 4.27½ to 4.32½, New York. As January progressed several of the producers became free sellers, and values declined to 3.90, St. Louis; 4.05, New York.

Towards the middle of February, higher prices for ore and a continued good demand on the part of consumers, both for galvanizing and brass purposes, combined to stop the downward tendency, and for a while considerable activity resulted, prices advancing to 4.10, St. Louis; 4.25, New York. The market ruled steady throughout April and May, when a further advance set in, in consequence of threatening labor troubles. A strike broke out at the beginning of June, and several of the smelters had to close down, which, naturally, caused quite a flurry in the market, values rising rapidly to 4¾, St. Louis; 4¾ to 5c., New York.

During the month of July the market was very active, and as it became evident that the supply of ores was rather short and the consumption of spelter very heavy, manufacturers were unable to supply themselves fully, and 5½, St. Louis, 5¼, New York, was freely paid.

August witnessed a further advance, spot metal being especially scarce. The quotations were 5¼, St. Louis; 5½ to 5½, New York.

It was not until the latter part of October that prices showed a tendency to ease off, and they would no doubt have declined very sharply had it not been for a fire which destroyed four blocks of one of the largest works in Kansas. As it was, the falling off in the consumption, which usually makes its appearance towards the end of the year, did not make itself felt until the second half of November. Inasmuch as production continued at a very heavy rate, stocks began to accumulate and prices declined sharply, closing considerably lower, 4.37½ to 4.40, St. Louis; New York, 4.55 to 4.57½.

THE SPELTER INDUSTRY IN 1902.

BY WALTER RENTON INGALLS.

The spelter industry during 1902 has been marked by numerous features of interest. The consumptive demand for the metal has been very large, in spite of a somewhat slack call from the galvanizers, and although production was very large the price for the metal rose gradually during the first half of the year, and remained at a high level during the second half, although since about November 1 there has been a sagging tendency. A consolidation among the producing interests had considerable effect on the market, but the latter was intrinsically strong because of natural conditions. Stocks have been depleted to a very low figure, and the large production has been consumed entirely at home, the domestic price having been uniformly far above the European level. In London the market opened at £16 10s. per 2,240 pounds, corresponding to \$3.58 per 100 pounds, and rose gradually to £19 7s. 6d., corresponding to \$4.20, at the first of December.

The year opened with spelter at 4.30 cents, New York, which was already a substantial gain over the range of prices that prevailed during the major part of 1901. In February there was a slight setback, but in March a gradual rise began which became rapid toward the end of May and continued up to the middle of August, when 5.50 was quoted. At that point, which was the maximum for the year, the market remained stationary until about the middle of October, when a slightly weaker tendency became manifest; by the end of October it had become quite pronounced, and in November there was a rapid decline from 5.30 to 4.95.

In St. Louis the maximum price for the year was 5.25, the difference in the quotations of the two markets having been 25 cents per 100 pounds, instead of the normal 15 cents, to which relation the quotations gradually returned during the decline in November.

The value of standard ore (60 per cent Zn) in the Joplin market was about \$27 to \$28 during the most of the first quarter, the highest grades fetching \$30 to \$31, and the production was large.

There was a slight increase about the middle of March, and toward the end of that month some of the important producers organized a pool for the purpose of compelling the smelters to pay a flat price of \$37.50 per ton for the high-grade ore. A little was sold at that figure, but it was more than the smelters could afford to pay at the existing price for spelter, and they simply withdrew from the market. This disrupted the pool, and at the end of April its holdings were disposed of on a \$30 basis, which was a very good price, considering that spelter was then only 4.15 cents at St. Louis. In May the furnacemen at Iola threatened to strike, and, because of that, the smelters became chary of selling spelter, and the price of the metal rose rapidly, attaining 4.50 cents, St. Louis, at the end of the month. The smelters being not very keen bidders for ore under the circumstances, the price for the latter remained stationary at about \$30. The threatened strike actually materialized in June at one of the works at Iola and at the Edgar Works, at Cheryvale, but it did not amount to much, and soon terminated. The price of spelter continued to advance after the disappearance of the labor difficulties, but the price of ore was not at first bid up correspondingly, and at the end of June was only \$32, though spelter was at 4.75, St. Louis, and 5 cents, New York. This condition changed radically in July, when high-grade ore sold up to \$42 per ton and 60 per cent ore ranged from \$37 to \$40, but these were the quotations of a temporarily excited market, and they soon settled to a basis of about \$34 to \$36 for 60 per cent ore, which ruled during the period of maximum price for spelter. When the latter began to fall off the price for ore was dropped correspondingly, and at the end of November was about \$30.

The prices for ore, during the second half of the year especially, enabled the smelters to do well, and also afforded a very satisfactory return to the miners. Throughout the year the smelters utilized to the full their already large capacity and still further increased their means. During the spring the new works of A. B. Cockerill and the Standard Acid Company, each three-block plants, were put in operation. The works of the latter were soon purchased by the interests that had been operating the Southwestern Chemical Works at Argentine, Kan., and the two were consolidated under the name of the United Zinc and Chemical Company. This company makes sulphuric acid from the gases given off in blende-roasting, and is the first concern west of the Mississippi River to undertake that process. In May the New Jersey Zinc Company purchased the plants of A. B. Cockerill and the Prime Western Spelter Company at Gas, near Iola, and later bought the works of George E. Nicholson at Nevada, Mo., and Iola, Kan. The works at Nevada, which employed coal as fuel, have been closed, and the three in the gas field are operated under the name of the New Prime Western Spelter Company. Two new blocks of furnaces have been added to each of the plants at Gas, which are immediately adjoining, so that the three plants of the company in that district have now an aggregate of 15 blocks of furnaces, and in point of capacity the new company is equal to the Lanyon Zinc Company, which has been the largest individual producer heretofore.

A new plant of three blocks, erected by the Lanyon Brothers Spelter Company, at Neodesha, Kan., was put in partial operation during July, and was completed about the end of November. Construction was begun on the works of the United States Zinc Company, affiliated with the American Smelting & Refining Company, at Pueblo, Colo., and it is expected that this will be in operation in 1903. A new plant at Beaumont, Texas, to use petroleum as fuel, has been projected by interests identified with the New Jersey Zinc Company, and some preliminary work has been done, but there appears to be some uncertainty as to further prosecution of the plans.

There is now but very little Western spelter produced outside of the natural gas districts of Kansas, and the large plants at Lasalle-Peru, Ill. The recent prices for ore and spelter have afforded such a margin, however, that some of the old direct-coal-fired furnaces could be run profitably, and during the second half of the year the plant at Collinsville, Ill., was put again into commission, while the Edgar Works at St. Louis, Mo., have continued in steady operation. A plant at Sandoval, Ill., has been operated by the Sandoval Zinc Company.

The rolling-mill of the Lanyon Zinc Company at Laharpe, Kan. (near Iola) was put in operation during 1902. Another extension of interest in that district was made by the Cherokee-Lanyon Spelter Company, which has erected and blown in a small lead blast furnace to smelt the lead and silver-bearing residues remaining after the distillation of Colorado zinc ore in Sadtler retorts. Iola has become one of the most important metallurgical districts in the United States, and it is interesting to note the addition of lead, sheet zinc and sulphuric acid to its list of manufactures, all of which has been done during 1902.

In the Joplin District the year has been a prosperous one, owing to the high level of prices for both zinc and lead ore, which have been on the whole satisfactory to the producers. The output of the district shows a small increase over 1901. During the first eleven months the sales of zinc ore amounted to 244,000 tons, and there was said to be in the neighborhood of 10,000 tons of unsold ore on hand, the buyers not having been very keen for supplies toward the end of November. In 1901 the output of the district was 256,920 tons. Apparently the productive capacity of these mines under present conditions is approximately 260,000 tons, their output not having varied greatly during the last four years. High prices do not appear to increase it, nor low prices to check it materially, inasmuch as the fluctuations in price have been too rapid to evoke a strong tendency either way.

The small increase in the Joplin production in 1902 is insufficient to account for the increase in the spelter production. The latter has been due largely to the more extensive use by the Kansas smelters of ore from Colorado. There are no statistics as to the quantity derived from the latter source, but from the known consumption of it by certain smelters the total must be already important, with strong promise of further increase in the future. Besides Colorado, some lots of ore have come from Utah, and recently some importations from the Slocan District in British Columbia have been made, one of the Iola smelters having sent an agent there to investigate the conditions. A freight rate of \$11 per 2,000 pounds from the Slocan to Iola has been named, which, although a large tax on the ore is but little more than what has been borne by the Leadville ore for carriage to Antwerp. The Utah ore has also to stand a high freight to Iola, but from Colorado points the rates are comparatively low.

These Western ores are produced generally from material which yields a comparatively large percentage of both argentiferous galena and blende, and the latter being more or less in the nature of a by-product, it can stand a high freight and still afford a satisfactory profit to the miner, while the smelters are able to get it for a considerable discount from the relative price of Joplin ore, with which it can be mixed to a rather large proportion without greatly affecting the results in smelting. This new supply of ore has consequently emancipated the smelters from the Joplin District to a large extent, and freed them from the danger of concerted action on the part of the Joplin miners, such as has been tried on various occasions. The magnitude of the deposits of these ores in the Far West, together with the Southwest and the

Northwest, their widespread occurrence, the high tenor of zinc in the crude ore as mined and its common association with argentiferous galena give the assurance of a great new supply of cheap zinc ore, of which it is difficult yet to foresee the full effect. The ability to produce a high grade zinc ore, which, although inferior to the exceptionally pure Joplin ore, is, nevertheless, of fairly good quality, by means of improved methods in wet concentration and magnetic separation has been fully demonstrated.

Up to the present time there has been the greatest activity in marketing these ores from Colorado, which is natural, inasmuch as the mines of that State are nearest to the smelters and have the advantage of the lowest freight rates. Also the deposits of zinc-lead ore, especially those of Leadville, are among the largest. Other deposits are worked at Kokomo, Creede, Rico and elsewhere. The ores are shipped to smelters in Europe and in Kansas, and to the Mineral Point Zinc Company for zinc oxide manufacture at Mineral Point, Wis. A good deal is sent to Canon City, Colo., for the manufacture of zinc-lead pigment. The works at Canon City, which were formerly operated by the American Zinc-Lead Company, were purchased in 1902 by the United States Smelting Company (a branch of the United States Reduction & Refining Company, which consolidated most of the cyanide and chlorination mills of the Cripple Creek District), and were considerably enlarged. Two magnetic separating plants were put in operation in Colorado during 1902, one by the Colorado Zinc Company at Denver, Colo., and the other by the Empire Zinc Company (a branch of the New Jersey Zinc Company) at Canon City. Others are planned.

It is not only in the Joplin District and the Far West that there has been great activity in zinc mining in 1902; the deposits in the less remote States have received considerable attention. Wisconsin is said to have made an increased output. Several thousand tons of ore have been shipped from the vicinity of Marion, Ky., where the developments have excited considerable interest. Further prospecting has been done in Tennessee, but its deposits, although of widespread occurrence, do not appear to have much commercial promise. Most disappointing has been, perhaps, the record of Arkansas, which has known zinc resources, but of disputed value. Railroad lines have now opened the district to some extent, and under the stimulus of the high prices of 1902 it ought to have made some practical showing, but it does not appear to have done anything of consequence. New deposits of zinc ore are said to have been discovered in the Indian Territory.

As to Virginia there have been few new features of interest. But very little prospecting work has been carried on, and this has resulted in nothing but negative information. At the Bertha mines the work of stripping and removing the limonite ore has proceeded on a large scale. The Bertha Company is now considering a plan for utilizing the tailings dump from its old zinc mill, which contains 30,000 to 40,000 tons of material, having an average content of about 18 per cent of zinc. It will, however, be some time late in the coming spring before actual operations will be under way. The Bertha Company's mill at its Clark mines, in Pulaski County, has been running successfully throughout the year, producing a very satisfactory grade of zinc ore (calamine). The Wythe Lead and Zinc Company has been carrying on its usual mining operations at Austinville. The mechanical roaster which it installed about a year ago was not successful, so it returned to the old hand-operated, reverberatory. The capital stock of this company was purchased last summer by the Bertha Mineral Company, which will probably, during the next year, develop the property on a larger scale; inasmuch as the stripping at this place is very heavy it will re-

quire considerable additional outlay and improved methods to enable the ore to be recovered at a satisfactory cost.

It is manifest that with the possession of the great zinc ore deposits of New Jersey and Joplin, together with those of the Far West, the Northwest and the Southwest, besides the less important deposits of Virginia, Wisconsin and some other States, this country is confronted with no prospect of a deficient supply of zinc ore, but on the contrary will have a large surplus to export to Europe.

In Europe the course of the zinc market in 1902 indicates a return of prosperity in the industry, the price for spelter at London at the close of the year being close to the average for the ten years, 1891-1900. The situation in the United States precluded any competition in spelter therefrom, and developments both in America and Australia gave the assurances of certain supplies of cheap ore. In 1901, according to the report of the inspector-general of mines, the smelters of the Liege District in Belgium received 28,458 metric tons of ore from America (including presumably Canada and Mexico, together with the United States), and 15,098 tons from Australia, a total of 43,556 tons out of a consumption of 292,027 tons. The spelter production of the Silesian smelters, who depend chiefly upon ore mined in their own district, increased in 1902. In the first semester they turned out 57,493 metric tons, as compared with 52,312 in the corresponding period of 1901. Their total production in 1901 was 107,967, against 102,213 in 1900, but stocks on hand increased from 7,950 tons January 1, 1901, to 14,193 January 1, 1902. The smelting capacity of the Province is now to be increased by a new plant at Hohenlohehutte, which is expected to be in operation about the end of 1903. The plans of the managers of the Hohenlohe business are understood to have been instrumental in defeating the project for a new convention to regulate the production and price of spelter in Europe, which was in negotiation a little more than a year ago, although there were other parties thereto who were desirous of limiting the output of every one but themselves.

THE PROGRESS IN THE ZINC INDUSTRY IN MISSOURI DURING 1902.

By FRANK NICHOLSON.

Perhaps the most striking fact in the history of the Joplin Zinc District for the past year is the unmistakable decline in the productive capacity of the outlying districts, and a counterbalancing increase in the production of the older camps. The accompanying charts give the production of the various districts for the last half of 1901 and the first six months of 1902.

The largest gains were made by Carterville and Duenweg, followed by Joplin and Webb City. The serious falling off is shown by Roaring Springs, Carl Junction and Oronogo. Oronogo, it is true, is one of the oldest producing camps, and is an exception to the general rule that the older inside districts have shown an increase in production for 1902. On the other hand, Neck City and Alba are outlying districts, and are also an exception to the general rule, in that they show a material increase in production for 1902. The district, as a whole, is fairly steady; and while 1902 has been the record year in zinc production, yet the increase will not amount to 1 per cent over that of 1899, which has heretofore held the record.

Prices during 1902, both for lead and zinc, have been fairly steady and most satisfactory. The average price per ton has been \$30.70 for zinc and \$46.44 for lead concentrates. The output of zinc ore shows a slight increase over 1901, while the output of lead shows a falling off of about the same amount.

A matter of great interest to the district has been the consolidation of various smelting interests and the reappearance of the New Jersey Zinc Company in the Joplin field. The effect of this concentration of the smelting interests into fewer hands has not as yet been particularly felt in the district, and a variety of opinion exists as to whether the result, when ultimately disclosed, will be beneficial to ore producers or otherwise. While there has been a partial merger of the zinc smelting interests, the number of producers has not been lessened, the actual operators probably being quite as numerous to-day as they were a year ago.

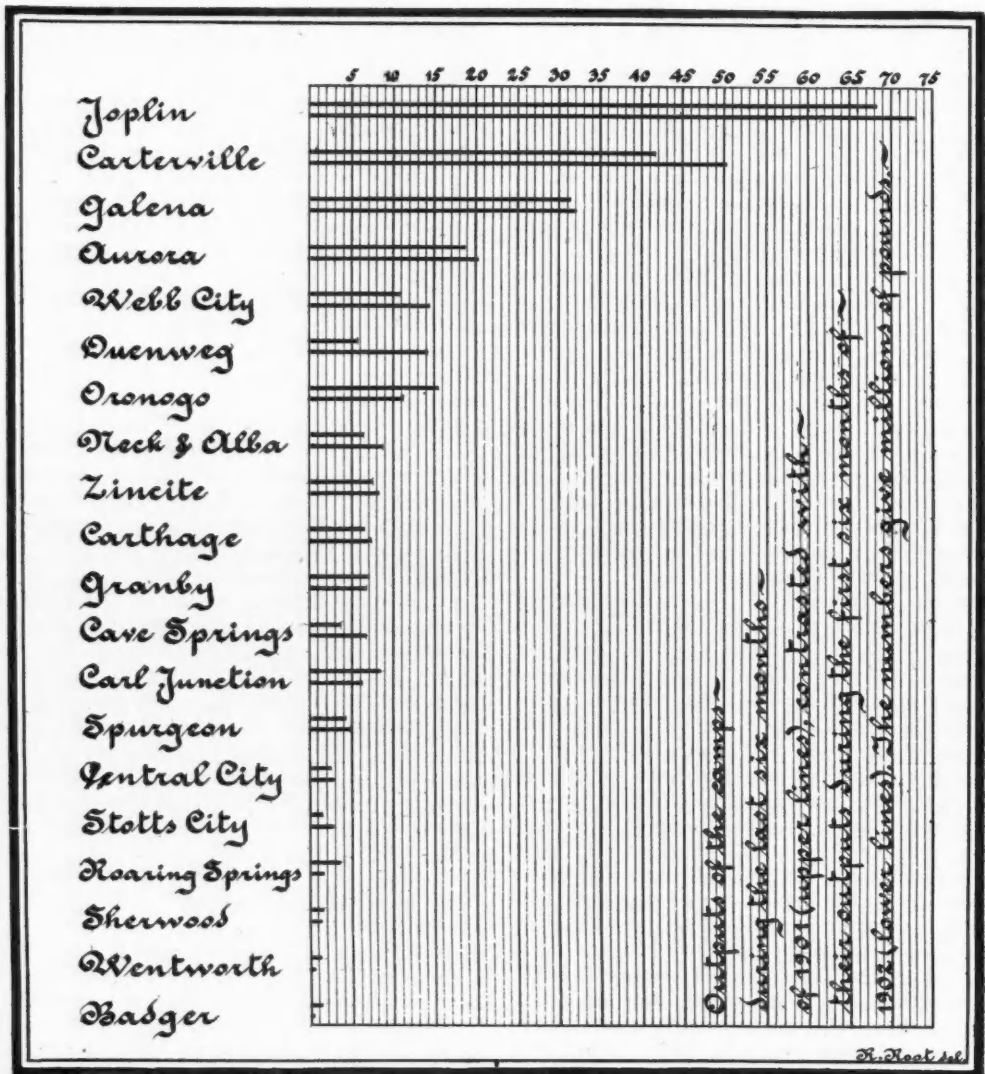
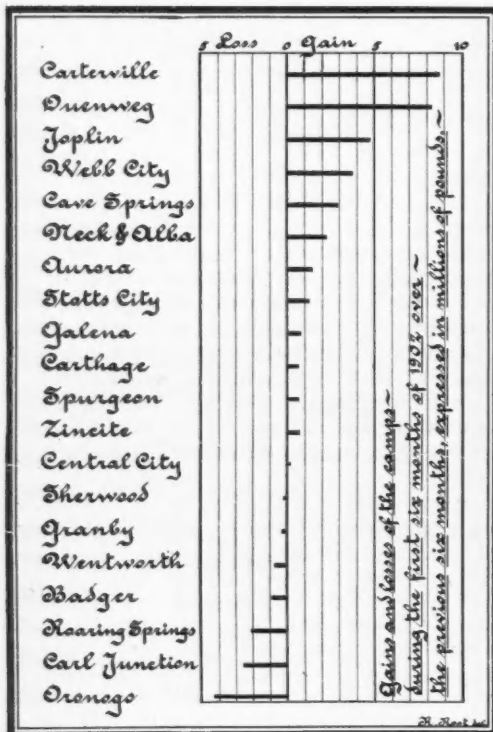
A large amount of speculation has been indulged in, and on every hand is heard the report that this or that syndicate is about to secure control of the output of the district. The large number of operators, however, together with the varying fortunes of any individual mine make it highly improbable that any general merger of interests in this district can be effected among the ore producers. Suggestions have been made looking toward the formation of an ore purchasing company, which shall buy the entire output of the district, warehouse and grade the product and

The plan attracted a great deal of attention from the smelters and ore buyers, and resulted in a material advance in the price of ore. This advance in the price of ore cooled the enthusiasm of the operators who, when ore reached a \$35 basis, no longer cared to enter into contracts with a company whose avowed purpose was to prevent excessive fluctuations in the price and keep it as nearly as possible at \$30 per ton. The plans of the ore purchasing company were thus necessarily postponed until such time as the condition of the market should again make their efforts desirable. It is probable that some such plan will ultimately be consummated, and will result in great benefit to the operators and also to the smelters. Both are interested in a steady market.

There were slight changes in mining methods, and the general situation both as to mining and

improved mills, now being built, raise the ore from the mine to the top of the derrick about 40 feet above the collar of the shaft. The ore is dumped over a grizzly, the finer material passing direct to the ore bin and the coarser material dropping on a floor, where it is fed into a rock-breaker, which delivers it into the same ore bin already mentioned. From this ore bin, with a capacity of about 200 tons, the ore is fed automatically into the rolls and follows the usual channels through the mill. This improved arrangement of the deck-head saves at least one man in the mill, and feeds the rolls more uniformly than is possible in the usual practice.

No Joplin ore has been exported during 1902, although there was serious talk of export during the early part of the year. A marked drop in the price of ore set in about September, when the top price was \$39.50. From that time a steady



resell to the smelters at an advance of \$1.50 a ton. It is estimated that this amount will be more than saved by economies effected in the new method of handling the ore. It is proposed that this company shall pay to all producers a uniform price, which shall in no case be below \$30 per ton; and its efforts shall be directed toward maintaining a steady and uniform price for the output of the mines.

This proposed company would export any surplus production that might tend to interfere with the market price, and thus work in harmony with the commercial law of supply and demand. Any attempt to maintain the price without this export feature must, of course, fail, as the entire proposition would be based upon an economic fallacy, that the law of supply and demand could be disregarded.

Producers representing over 40 per cent of the entire output were induced to sign contracts agreeing to deliver all ore produced to this purchasing company; but the capitalists financing the company refused to undertake the work until at least 60 per cent of the output was under contract.

milling in this district shows but trivial variations from the practice of 1901.

The only change to be noted in the mining practice is the employment of heavier hoisting devices and buckets of larger capacity. Thus 1,000-pound buckets have generally been added to the new plants in place of the 500-pound buckets formerly used. This, of course, has necessitated heavier cables and stronger hoisting engines. The number of air drills used has greatly increased during the past year.

Very few mills have been built during the year, but a large number of old mills have been moved to new locations, and the number of operating mills is about the same as a year ago. The chief changes in milling practice have been the more general use of Wilfley tables and a different and better construction of the deck-head. The most

decline ensued, until on December 8 the top price had dropped to \$33, and the basis to \$28 per ton for 60 per cent ore. This decline was assisted by a car famine that became acute about the middle of November. This car famine seems to have been brought about partly by the general prosperity of the country, and the inability of the railroads to furnish the requisite cars to handle their offerings of freight; and in some degree by the slowness of the smelters in unloading the cars.

On December 8 there was a visible supply in the ore bins of the district amounting to about 10,000 tons, half of which had been bought by the smelters and paid for, but which, on account of the shortage of cars still remained in the bins of the producers. This large accumulation undoubtedly tended to unsettle prices, and it is the present hope and intention of the Miners' Asso-

ciation to export at least a portion of this surplus. With this idea in view bids were asked for 1,000 tons of ore for export, and producers were requested to contribute this at a price that would make it possible to take the ore out of the country. Several meetings of the producers were held and 1,000 tons of ore were promptly subscribed. The contract for export was awarded to Frank Nicholson, consulting engineer, at a flat price of \$23 per ton without deduction for iron or moisture. Mr. Nicholson has already begun loading this ore and expects to have it all out of the country by February 1.

Comparatively little Eastern capital has been invested in the district during the past twelve months, and of that which was invested the greater portion came from Boston.

The price of properties has advanced fully 25 per cent over the figures obtaining in 1901, and for this reason, in part at least, is owing the fact that Eastern capital has kept out of the district. The Joplin mine is a plant of quick growth. From the date of sinking the shaft to that of the exhaustion of the property ordinarily occupies from one to five years. The result is that the investor who loses money in the Joplin District loses it so quickly as to stagger him. Larger sums are lost in the Western mining districts, but the agony is so long-drawn out that the victim gets used to it.

As the mode of occurrence of the Joplin deposits becomes better understood and the methods of investigation are adapted to the requirements of the existing conditions, fewer mistakes are made in the determination of the value of properties; and as a field for investment the Joplin District becomes more inviting. The boom of 1899 has passed, and the business has settled down to a conservative basis that is full of promise for the future.

MINING DEVELOPMENT IN MEXICO DURING 1902.

By JAMES W. MALCOLMSON, El Paso.

Mining in Mexico stands upon a silver basis. In the central and southern portion of the country the Mexican miner earns as low as 50 cents, Mexican currency, and along the northern frontier as much as \$2 and \$3, Mexican currency, for a day's work. The value of silver, as compared with gold, has steadily fallen during 1902, and a Mexican dollar to-day is worth only 37 cents, United States currency. The gold cost of a Mexican miner's labor is, therefore, very small when compared with that of a miner in the western United States. Dollar for dollar, the amount of work which can be done by the average miner earning \$1.25, Mexican, per day in Mexico, is, roughly, two and one-half times as much as can be done by the average United States miner earning \$2.50, United States currency, per day, on the assumption that the United States miner can drill twice as much per day as his Mexican fellow-craftsman, which is not the fact. In other words, from a wage standpoint, a ton of ore can be mined in Mexico to-day for 40 per cent of what it would cost if the same ore were in the United States, supposing that the United States miner will do twice as much manual labor as his Southern competitor.

These were the conditions of 1902 in Mexico, and the result is that an extraordinary influx of United States and European capital has poured into the country, much of it seeking investments in mines of silver, gold, copper and lead. During the latter part of 1902 the purchase of silver mines by United States and English capitalists, rose considerably above what may be called "normal." An increase in the mining of silver, while silver itself was steadily falling in price, was a remarkable feature of this movement.

The greatest amount of development work has taken place along the lines of the railroads, and is due to the establishment and growth of the

smelting industry. In the smelters of Mexico, copper as a vehicle for the concentration of silver and gold values seems to be steadily displacing lead, and it is probable that recent improvements in the metallurgy of copper, and the large deposits being opened up, will increase considerably the quantity of silver and gold so handled.

The numerous lead mines of the American Smelting and Refining Company in Mexico have been shut down during 1902, on account of the low price of lead and the destruction of the El Paso Smelting Works by fire. Towards the end of the year steps were taken to reopen them. During 1902 the custom smelters throughout the Republic have suffered from a scarcity of siliceous ores, due partly to the decreased production of the mining districts of Pachuca, Pozos and Zacatecas, to the limited amount of railroad extension into new mineral districts, to the increased facilities for smelting and to the increased requirements of the smelting companies of Mapimi, Tezuitlan and Descubridora for silica as a flux for their basic ores.

The advance of the mining industry in Mexico during 1902 is largely due to the United States import duty of 1½ cents, United States currency, per pound on lead, thereby keeping Mexican lead ores in the country, and to the consequent reductions in freight rates from the mines to the local

Kansas City to the Pacific Coast, through Chihuahua City, will make this town an important smelter location.

State of Chihuahua.—The siliceous district of Parral has been worked with great activity. In the San Juanico, an old mine, which was reopened by the Hidalgo Mining Company, of Pittsburg, a siliceous vein in shale was discovered with high gold and silver values. A regular output of ore has been maintained.

The famous gold-silver bonanza of Pedro Alvarado, in the porphyry overlying the shale, held out splendidly during the year, but the outlook for the future is now said to be uncertain. The mines on the Veta Colorado have given a regular production of shipping ore. The Veta Grande and Verde mines on this ledge have been acquired by the Guggenheim Exploration Company. A rich ore body was cut in the Morena Mine on the same ledge by the Hidalgo Mining Company.

The Tajo Mine, in Parral, of the American Zinc Company, of Kansas City, has opened up a large siliceous deposit with silver, lead and zinc values.

At Santa Barbara the Guggenheim Exploration Company has opened up in the Tecolotes Mine an ore-body carrying sulphides of lead, zinc and silver. The crushed ore is screened, classified and passed over Wilfleys, a saving of 90 per cent of the lead being made. Gas-producers and gas



WHERE MOUNTAIN AND PLAIN MEET.

Mexican smelters which have been built up by this benevolent tax.

On account of the competition between the smelting companies, several of the powerful corporations are acquiring mines which will render them independent of market conditions. This movement was one of the features of the year.

The American Smelting and Refining Company and its ally, the Guggenheim Exploration Company, now own or control mines in the districts of Santa Barbara, Parral, Monterey, Sierra Mojada, Tepezala, Velardena, Chihuahua, Matehuala and Asientos, either by lease or direct purchase, and are still very energetically examining producing properties with the object of purchase.

The San Luis Potosi Smelter, with its allied organizations, the Mexican and Montezuma Lead companies, pursues the same policy. They own large mines in Sierra Mojada, Santa Barbara, Monterey, Sombrerete, San Pedro, Concepcion del Oro and other points.

The new Torreon Smelter in the State of Coahuila, which commenced its operations in 1902, already owns a very important lead mine, the Voladora, in the Monterey District, and is actively prosecuting the search for other mining properties. This smelter, consisting of four furnaces, smelting 12,000 tons of ore per month, located at the intersection of the Central and International railroads, although not yet twelve months old, has enough ore contracted ahead to run for three years.

In the North of Mexico the Kansas City, Mexico & Orient Railroad, now being built from

engines are successfully used in the power plant.

The Montezuma Lead Company, operating in the same camp, have erected a large concentrator, with jigs, handling a similar mineral. It is too early yet to make a comparison of the relative efficiency of the two processes.

A great number of other mines in the immediate vicinity of Santa Barbara and Parral have been operated during the year, and mills have been erected at the Adela, Union and Refugio mines.

The extension of the Mexican Central Railway into Parral and Santa Barbara, two and one-half years ago, found these camps working in a very small way, with but limited resources. To-day they supply all the smelters of the north of Mexico with siliceous ores; they maintain a largely increased population, and have enriched the whole surrounding country. The amount of American machinery and lumber shipped into the camp during 1901 and 1902 is something which has never been seen in Mexico before in so short a time, and the whole district is an instructive example of the benefits received by a large section through the extension of railroad communication. Parral is over 300 years old, yet it is no exaggeration to say that more ore has been mined since the arrival of the railroad than during the whole previous time.

In Santa Eulalia, American capitalists took over the Potosi Mine at the end of 1901, and have opened it up through the adjoining Santo Domingo property, with extraordinary success, at a depth of 1,300 feet. More than one-half the in-

vestment has already been repaid, one of the largest silver-lead carbonate ore-bodies ever found in the north of Mexico has been explored, and there is already in sight a profit of several million dollars. The owners of this property have been working in the camp for several years, and the discovery is a compliment to their energy and ability.

The adjoining mines of the Hearst estate and the Chihuahua Mining Company have mined large quantities of ore from below the 1,200-foot levels during the year, and the mineral railroad of the latter company is now running night and day to handle the output.

Work in the lead carbonate and galena mines of the American Smelting and Refining Company was resumed towards the end of the year.

Near the City of Chihuahua the Kraft Mine, containing fluxing ores carrying silver, gold, manganese and lime, was shut down during the first half of the year, on account of the fire at the El Paso Smelting Works. This mine is now producing 3,000 tons of ore per month, all of which is quarried out from open cuts. A very large amount of ore has been developed during the temporary suspension of operations.

Discoveries of lead carbonate and siliceous ores, which may prove to be of importance, were made during the year at Terrazas and Victorino, some 40 miles to the north of Chihuahua, and considerable prospecting work is now being done at both these points. The copper mines and smelter of the Rio Tinto Mexicano Company, also at Terrazas, has suspended operations on account of the low price of copper.

In the Sierra Madre Mountains the gold-silver quartz ores are receiving considerable attention.

In the Jesus Maria District, which produces 100,000 ounces of bullion per month, worth over \$1, United States currency, per ounce, the ore is treated by pan-amalgamation entirely, but the loss is probably between 35 and 40 per cent of the silver and gold contents. The ore, however, is high-grade and the district attracts considerable attention. It is estimated that there are 5,000 mules on the trail from the railroad at all times. The cost of mule freighting is \$60 per ton. This camp to-day is 60 miles, as the crow flies, from a railroad, but it is one of the most permanent camps in the State, and needs better transportation facilities. An English company has just acquired one of the principal mines. The problem of successfully treating the gold-silver mineral of this section has been solved by the Concheno Mining Company, of Cleveland. The ore here is crushed by stamps, passed over Wilfleys, where a 2,000 to 1 concentration is effected; the sands are cyanided in the usual way, and the slimes, which are extremely fine, are cyanided by agitation and filtered through powerful filter-presses.

The Dolores mines to the north, owned by the promoters of the Jumpers Mine, of California, have shipped during the year several hundred tons of ore assaying over 500 ounces of silver and 6 ounces of gold per ton. Still farther north the Dos Cabezas Mine, in the State of Sonora, has opened up a very large siliceous silver-gold deposit, somewhat similar in character to that at Concheno. At all these points the problem of local treatment is receiving the attention of the leading mill-men of the United States. So far, the best work shows an extraction of 80 per cent of the gold and 55 per cent of the silver contents by a combined cyanide process.

The Kansas City, Mexico & Orient Railroad, now building, will run diagonally through Chihuahua from the junction of the Conchos and Rio Grande rivers, through Chihuahua City to Fuerte. Between the Rio Grande River and Chihuahua City deposits of lead and copper in limestone are being actively prospected, and large bodies of ore are known to exist. To the west the camps of Barranca de Cobre, Batopilas, Urique, Guazapares and Palmarejo are being greatly

benefited, and during the year much attention has been paid to all of them by investors. A silver bonanza of great value was uncovered in the Batopilas mines; but the untimely death of Mr. A. L. Shepherd, of Washington, D. C., has been a great blow to this district.

A gold quartz vein near Fuerte, the Lluvia de Oro, attracted much notice during the year. The values are said to be high, but the property is at a great distance from the railroad.

At Naica, near Santa Rosalia, high-grade basic lead-silver ore bodies were discovered, and a regular production maintained during the year.

The Adargas mines near Jimenez, producing siliceous gold, silver and lead ore, reduced shipments considerably during the past six months. At Carralitos a large tonnage of siliceous lead sulphides, 5,000 tons monthly, is mined and shipped to El Paso.

State of Coahuila.—Operations in the Sierra Mojada mines, which usually produce very large quantities of silver-lead carbonates, together with lime and iron ores carrying silver, have been very much reduced during 1902, owing to the fire at El Paso. Towards the end of the year these properties are being reopened.

The Fortuna mine has been worked very actively, a rich deposit of silver-lead carbonates having been discovered. The fire in the San Salvador mine burned during the whole year. There were over 30,000,000 feet of lumber in this mine in square sets, and immense quantities of native sulphur. It is difficult to anticipate when the fire will be extinguished, as there is no water in the camp. In the Fronteriza mine a valuable extension of the main ore zone, has been discovered and worked; but operations here and in the adjoining Encantada Mine of M. Guggenheim Sons were interfered with by the San Salvador fire.

The blowing-in of the Torreon Smelter stimulated mining considerably in the southern part of the State, and a number of very good lead prospects are being developed.

The Norias de Bajan, Cerralvo and Cuatro Ciénegas silver-lead camps have been operated steadily; but on account of the price of lead and the distance of the first two from railroad transportation, they have not been very prominent.

At Viesca, a smelter has been erected to treat the low-grade siliceous copper carbonates, of which there are very large bodies carrying some silver.

In the coal region of Coahuila an accident, killing over 140 men, seriously retarded operations at Sabinas. The Esperanzas mines, opened in 1901, now produce 40,000 tons of coal and 6,500 tons of coke monthly.

State of Nuevo Leon.—The Monterey lead carbonate district has been very successful during the year, the production being over 200,000 tons. The Villaldama and Montanas deposits, located on parallel ranges of mountains 20 miles apart, and the similar deposits now being so vigorously developed at San Pedro and San Pablo, are on the east coast range of the Sierra Madres. The Mitre, Volador, Aztec and Carbonate mines are in the Mitre mountains of the same range. All these deposits are similar in character, the ore horizon being practically the same. The outlook for 1903 is good; but the sulphide zone has not yet been reached, and some doubt is expressed as to its importance. An enormous ore-body was found in the San Pablo Mine of the Mexican Lead Company, but later on a serious cave interfered with operations. The ground, however, is now secured and the mine in running order again. The production from the Aztec and Carbonate mines of the Monterey Smelting and Refining Company is only limited by the necessities of that plant. During the year the Zaragoza silver-lead mine has been acquired and operated by the Guggenheim Exploration Company.

State of Sonora.—The southern portion of this State has suffered on account of the feeling of insecurity, due to the Yaqui disturbances. In the central portion of the State freighting almost ceased for want of pasture for several months.

The Green Consolidated Copper mines at La Cananea have proved to be as productive as their most sanguine promoters ever dreamed. The lowest workings have not shown values equal to those on the upper levels, but there is good reason to expect a long continuance of the present rate of production. Production from the Nacozari mines of the Phelps-Dodge Company has been steadily maintained. The installation of fuel gas producers and gas engines in the Nacozari power plant has been very successful. The completion of the Cananea smelter, the Nacozari smelter, and the building of two smelters—the Phelps-Dodge and the Calumet & Arizona at Douglas, on the United States border—marks a new era in the history of mining in this State. The extension of the railroads into the southern siliceous mining camps is now a matter of months only, and numerous surveying parties are already in the field.

The gold quartz mine of Picacho, north of Arispe, belonging to the Phelps-Dodge Company, is now clear of the vexatious litigation which has interfered with operations so long, and regular shipments of high-grade ore are being made. South of Arispe, the Chispa mine has again commenced to ship high-grade gold-silver ore; but the excessive cost of transportation from the Sonora, Oposura and Yaqui valleys to the Sonora Railroad retard development in that section.

The extension of the El Paso & Southwestern Railroad to Douglas, on the United States frontier, with the Mexican extension to Nacozari, has stimulated mining considerably in the northern portion of the State, and the entry of the Phelps-Dodge Company into the custom smelting industry on a large scale helps the mineral development of Sonora in a way that is only commencing to be appreciated. A siliceous silver camp, the Pilar de Teras, is producing a good deal of high-grade ore, and has come to the front very rapidly. Its development and present importance is due entirely to the building of the railroad and the settlement of pending litigation during the year. On account of their location the Lampazos silver mines and the lead properties to the east, in Sahuaripa, have received but limited attention, and no change of importance has taken place.

La Dura and La Bufa mines in the Yaqui River country, shipping lead-copper-silver concentrates have maintained their value and production, La Bufa Mine being put on the California market as a stock company. South of the Batuc District, along the Yaqui River, the Santo Nino copper district is being prospected. The Minas Prietas gold district is not so active as formerly. The Grand Central Mine seems to have shut down permanently; the plant erected for cyaniding tailings has had a successful life, but the tailings have all been treated. The Creston Colorado mines, of Cleveland, seem to be the only properties operating successfully in the camp.

Considerable attention has been given to the San Marcial and La Barranca anthracite coal-fields; but the future of this district depends largely on railroad construction, which is going forward very slowly. These deposits are peculiar—the coal seams and the overlying limestone being cut by porphyry dikes. On the contact, between the lime and the dikes, silver-lead carbonates were mined, but on reaching the anthracite the silver-lead was cut off, and the district assumed a new importance.

Around Alamos a large amount of prospecting is going on. The Piedras Verdes and Quinteras copper-silver mines still produce the bulk of the values in that region, and ship mattes assaying

200 ounces silver, 40 per cent copper and 20 per cent lead.

During the year the Colorado de Ures property of the Mexican Gold and Silver Recovery Company closed down.

State of Durango.—The silver-lead-copper mines and smelter of the Velardena Mining and Smelting Company, of Omaha, were sold in November to American Smelting and Refining Company interests. These mines have shown up very well in depth, and the purchase will radically affect the smelter situation in that part of Mexico.

opened up large bodies of ore, but is still struggling with the treatment question. The ore is iron pyrite, carrying 0.5 ounce of gold per ton and 0.5 per cent copper.

The owners of the Descubridora copper mines, near Conejos, have opened up immense quantities of basic silver-copper carbonates. Their smelter was completed during the year, and they are now in the market buying siliceous ores.

The construction of the International and Central Railroad branches to Guanacevi have both been suspended, and this camp, probably the

litigation, and development work in proper form has been commenced. These mines will probably rank among the best in the State, and are already shipping high-grade concentrates, low in silica.

The Jimulco Copper Mining Company has reached the dividend stage. During 1902 a steady production of high-grade copper ore was maintained. The shipments were 1,800 tons monthly of ore assaying 0.2 ounce gold, 20 ounces silver and 9 to 10 per cent copper. This property is in an almost entirely undeveloped region.

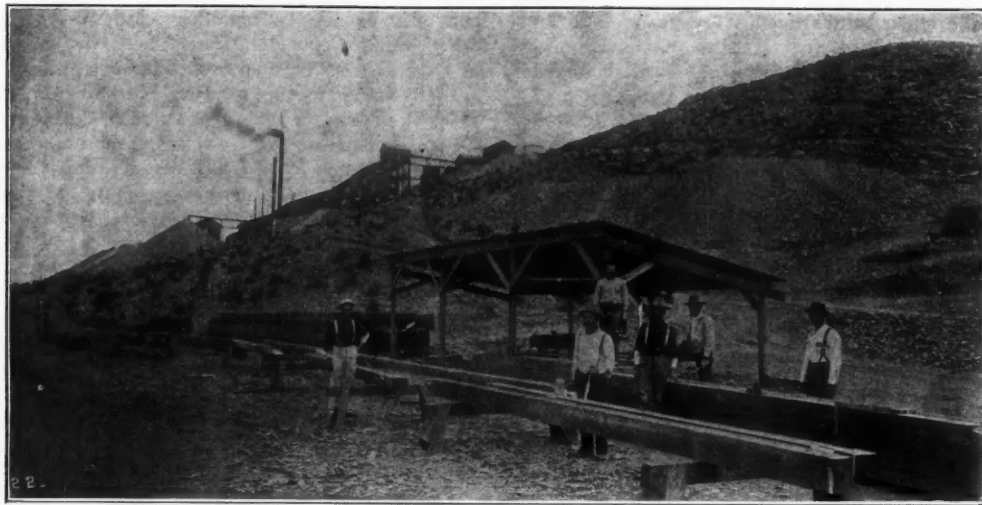
In Guadalupe y Calvo, Montana capitalists have been developing the ancient Rosario Mine. The old workings contain very large quantities of silver-gold ore, which can be profitably treated by leaching processes. The extension of the Parral & Durango Railroad into the camp is about to be undertaken. A Scotch company at Santa Juliana, in the same district, also holds a very promising gold-silver mining property, but is handicapped by the difficulties of transportation.

At San Juan de Guadalupe, some successful mining is being prosecuted on a limited scale in the lead and silver deposits.

The San Andres de la Sierra silver-lead mine, northwest of Santiago Papasquiario, ships \$100,000 of base bullion monthly. This mine is three days from the International Railroad, and has been producing steadily for twelve years. The present outlook is more promising than ever before. During 1902 the company suspended refining operations, and instead of shipping bar silver to the local mints now ships lead bullion to New York City.

The Bacis Gold and Silver Mines, Limited, an English company, maintained a steady output of siliceous gold-silver ore. The property is three days from the railroad on the Bacis River, and the ore is concentrated and pan-amalgamated. This company has been operating steadily for ten years and is running 40 stamps.

A Canadian company at Trinidad, the Cushing & Walkup Company, increased their output of siliceous gold-silver-copper ore. The ore is smelted and the matte shipped to the Aguas-



A BIT OF ARIZONA SAGEBRUSH SCENERY.

The Compania Minera de Penoles at Mapimi is the most prosperous enterprise in the State of Durango. During 1902 171,000 metric tons of ore were mined, producing 92,000 kilograms of silver and 24,000 metric tons of lead. The ore production at present is over 500 tons per day. The ore is found in a series of irregular pipes, which have been explored to a depth of 2,300 feet. The ore-bearing zone is developed by a number of main levels from which diamond drill holes are run out on each side for a distance of 200 feet; the whole area is gridironed with drill holes 25 feet apart. Nine diamond drills are in operation continually.

A feature of mining operations at Penoles is the use of underground electric hoists for underhand stoping; 30 electric hoists are operated, varying from 1 to 50 horse-power, and this method of development has proved to be the most successful in the opening up of ore reserves.

An electric storage battery was installed during the year which has reduced appreciably the amount of fuel consumed in the power plant.

At the smelter a complete reverberatory roasting plant has been erected, but is not yet in operation. The company pays \$125,000, Mexican, in dividends per month. The ore is a basic lead carbonate, carrying some arsenic.

The Promontorio silver-gold siliceous mine of a German corporation produced a greater tonnage of ore during 1902 than during any previous year in its history. The extension of the International Railroad to Chinacates, north of Durango, has enabled the owners of this mine to ship grades of ore which before were always locally treated with indifferent success, and the profits of this property during 1903 will probably be very large.

A copper-gold mine northwest of Durango City, also known as the Promontorio, has attracted some attention during the year. The ore-bodies are large, and the mines are owned by an Anglo-German company. A concentrator and matte smelter is being erected to treat 100 tons of ore daily.

The Lustre Mining Company, of Pittsburg, operating the Magistral Mine, near Inde, have

most important siliceous district in the country, is still saddled with high freight rates and heavy milling losses.

The Avino Mines of Mexico, Limited, have very large low-grade siliceous silver ore-bodies, considerably over 2,000,000 tons of ore being in sight. Development during 1902 has demonstrated the presence of copper oxides, with native



A COLORADO MINING TOWN.

copper, in the lower levels. The concentration works have been dismantled and a hyposulphite leaching plant erected and put in operation treating 100 tons per day. The extraction is said to be 85 per cent of the silver and 30 per cent of the gold contents.

The Vacas silver-lead mines, in the hands of New York and Syracuse capitalists, seems to have ended the period of apparently interminable

Calientes smelter. It assays 350 ounces silver, 8 ounces gold and 20 per cent copper. This camp is also three days from the railroad. The owners of this property started with nothing, and production has steadily increased for seven years, the 1902 output being larger than during any previous year.

The Candelaria Consolidated Mining Company, of California, at San Dimas, also increased the

output. The ore is siliceous gold-silver, and is treated by stamps and pan-amalgamation.

California investors at La Puerta near San Dimas have uncovered a large body of gold-silver ore, and are building a mill. Around San Dimas a great deal of prospecting is going on, and considerable gold-silver bullion is shipped. All this goes on mule back to Mazatlan on the west coast, and is shipped over sea to San Francisco.

The value of the ore produced in Durango is second only to that of Chihuahua. The official statement of production during 1901 was: Value of gold mined, \$1,125,800; silver, \$12,994,140; copper, \$368,800; lead, \$76,260; total, \$14,565,000.

State of Oaxaca.—The Oaxaca & Ejutla Railway has been extended recently into the district of Taviche and the operations in the Ocotlan mining camp have been very active. During 1902 the principal mine in the district, the Escudra, containing siliceous silver-gold ore, was purchased by Omaha capitalists. California and Seattle investors have also secured some excellent properties. The camp is rapidly coming into prominence and has attracted a great deal of attention throughout Mexico. The development of this district is an interesting example of the results of the pushing forward of transportation facilities into undeveloped mining districts. About 1,500 tons of ore, assaying 90 ounces silver and from 0.2 to 0.5 ounce gold, is being shipped monthly, and a local treatment plant is under construction by the Taviche Milling Company, of Denver.

The gold-silver ore-bodies of Ixtlan are being worked very actively and large profits are being made by the owners of the Natividad Mine.

State of Jalisco.—Work has been started on the extension of the Guadalajara branch of the Central Railway to the Pacific. This railway, from Sayula to Colima, passes through an almost virgin copper-gold country. The climate is perfection; the population is thicker than anywhere else in Mexico; labor is cheap, and on account of the proximity of the district to the Aguascalientes smelter, ore can be readily marketed. This district in 1902 received some attention, and shipments of ore are already being made.

On the Santiago River the Castellanos gold-silver mine has been purchased by the Mexican Gold and Silver Recovery Company.

State of Chiapas.—The copper-gold mines of Santa Fe have been worked steadily, and an excellent record has been made by the management.

State of Guerrero.—In this State the ancient camp of Taxco, said to have been worked by Hernan Cortez, is again receiving some attention. The ore-bodies are similar to those of Noxtepec, Zacualpan, Tamascaltepec and Sultepec. They are large in extent, but very low in silver contents, usually not exceeding 15 to 20 ounces silver per ton as silver sulphide. The ores contain lead, zinc and iron sulphides in such proportions that it is difficult to find a process to handle them profitably.

A large body of pyrrhotite, which contains greater values than either Mount Lyell in Tasmania or the Mountain Copper deposits of California, has been discovered and opened up in the Campo Morado. Denver investors have secured an option on the property and are developing the ground. The ore lies on a contact between black shale and igneous rock, and assays 0.2 ounce gold, 6 ounces silver, 2 per cent copper, 40 per cent iron, 5 per cent silica, and 45 per cent sulphur. One million tons of ore are already demonstrated to be in sight. Small lenses of higher grade ore have also been found.

The quicksilver mines of Huizuco have now been worked to a great depth, but the ore production has not been maintained at the standard of previous years.

State of San Luis Potosi.—In the silver mine of La Paz in Matehuala, a new bonanza has been found in the sulphide zone. Since 1896 this mine paid \$5,000,000 in dividends, and the 1902 bo-

nanza, at a depth of 1,500 feet, assures the future of the mine for a long time. The La Paz mining claims cover a large vein system of parallel ledges, some narrow, but all of very high grade; streaks two and three inches wide are worked with advantage by leasers, which could be worked in no other way. The production is 4,000 tons monthly of 45 to 50-ounce ore.

The Guggenheim Exploration Company has secured in Matehuala the Trinidad and the stock of the Azul Mine, both adjoining their Dolores property, which is a producer of copper ore carrying small quantities of silver and gold.

Catorce has developed nothing of importance in the silver mines during the year. The antimony production from this district during 1902 and for previous years has been large enough to dominate the price of the metal. The ore is found as an earthy oxide; as shipped, it assays over 45 per cent, and occurs in limestone near the surface. A metallurgical plant for local treatment of lower grade, 30 to 40 per cent, ores has been erected at Wadley. Heretofore the ore has been shipped to Newcastle, England.

In Charcas the silver-zinc mine of Tiro General has received some attention, and a group of local mining and smelting men are developing the property and shipping a considerable tonnage of ore.

State of Zacatecas.—In the city of Zacatecas, the San Rafael group of mines, covering a large portion of the silver mineral belt, has been acquired by English capitalists. The ore is siliceous, and is still treated by the patio process, a method of treatment now gradually disappearing on account of the steady increase in the Mexican price of quicksilver and forage, and the competition of the smelter corporations.

The famous Bote mine is still a steady producer of gold-silver ore.

Some attention has been paid during the year to the Zacatecas gold belt. It is probable that the introduction of the cyanide process will help operations materially next year in this ground.

Operators in the Veta Grande silver mines have been very successful. Development is going on on a large scale in the Mala Noche Mine of Mr. Walter Palmer, demonstrating the value of the ore deposit in depth.

At Concepcion del Oro and Mazapil the building of a smelter and a railroad into this gold-copper camp by the Mazapil Copper Company, has been the cause of increased activity. Many mines are being developed which will become of importance in the near future, but the operations of the Mazapil Copper Company have been somewhat handicapped by shortage of water, and the fall in the value of copper. The production of copper and lead ore is approximately 7,000 tons monthly from this district.

The Minillas camp produces lead sulphides, with high silver contents. Two properties, the San Carlos and Santa Maria de Guadalupe, worked by local capital, have paid very large dividends during the past two years, although the mines were only discovered by accident about three years ago.

The Sombrerete mines have been worked very energetically; the lixiviation plant has been running steadily, and the shipments of high-grade ore have been maintained throughout the year.

State of Guanajuato.—The ancient siliceous silver-gold mining district of Guanajuato has received an impetus during 1902 from the entry of United States capitalists, who have secured some of the most famous of the old mines. The character of operations in this camp has changed more than in any other part of Mexico.

These mines are believed to have produced one-sixth of the silver of the world; one of them, the Valenciana, having an established record of production of over 300,000,000 ounces of silver.

At present quotations the gold in these ore varies from 15 to 50 per cent of the total values. In the patio process 75 per cent of this gold is

lost. The Guanajuato Consolidated Company, of Boston, during October, with 40 stamps at the Sirena Mine, milled and treated by pan-amalgamation, 100 tons of ore daily. The extraction was 85 per cent of the gold and silver values. The cost of mining and milling was \$10.11, Mexican currency, per ton, and as there are enormous bodies of ore in sight carrying values of over \$20, Mexican, per ton, the outlook for the property is very good indeed. The Aparecida, La Luz, Cubo, Refugio, Carmen and Bolanitos mines have been taken up by Boston, Chicago and New York interests, with the object of introducing American methods of mining and milling, and a partnership mill capable of handling 1,000 tons of ore daily is under consideration. The native owners of Esperanzas, Cedro and other famous properties are also alive to the need of reorganization in view of the rise in the silver value of quicksilver, forage, dynamite, steel and fuel, and there is no doubt that this camp will resume the premier position it has held for 200 years in the silver mining industry. No matter to what price silver may fall, the gold contents of the ores will continue to sustain profitable operations for many years.

Exploration work during 1902 has demonstrated that the deeper mines were abandoned on account of the cost of unwatering, and very valuable ore deposits have been revealed in the bottom of the old workings. The construction of mills and mine development are being prosecuted with great activity.

Power in Guanajuato under the most economical conditions cost during 1902, \$350, Mexican, per horse-power per year. The Guanajuato Power and Electric Company, of New York, Colorado and San Francisco owners, completed arrangements during the year to transmit 6,000 horse-power from the Duero River, near Zamora, in the State of Michoacan to the mines, a distance of 100 miles. This will reduce this cost to less than \$200, Mexican currency, per year per horse-power, and will help milling operations considerably.

At Pozos, operations during 1902 have been very much more active than during two or three previous years, and considerable interest is again being taken in mining operations in this district.

State of Aguascalientes.—The copper mines of Tepezala, operated by M. Guggenheim's Sons, have maintained a steady production of siliceous silver-copper pyrites.

The Aguascalientes Metal Company, operating in Asientos, has maintained a steady output, and in the same camp the American Smelting and Refining Company purchased the Santa Francisca Mine in March, after uncovering a very large body of siliceous silver-lead zinc sulphides.

State of Mexico.—The gold mines of El Oro have been operated with great success during the year, but the scarcity of fuel is becoming a serious feature. The owners of the Dos Estrellas Mine, after a long period of prospect work, have cut a rich and productive ore body. El Oro Mining and Railway Company has acquired a large number of claims adjoining their properties and have increased considerably the prospective future value of their enterprise. The value of these mines and of all gold mining properties in the Republic has increased on account of the fall in the value of silver.

This camp is the richest gold mining district in the Republic. The ore is found as gold quartz in shale capped by igneous rock. The crushed ore is carried over plates, and the residues cyanided, 80 per cent of the total values are recovered and the profits made are very large. The adjoining camp of Talpujahu is a silver camp of great antiquity and the change from silver mining to gold mining in this district resembles the similar change in Colorado after 1893.

State of Michoacan.—The operations of the Inguaran Copper Company have not increased during the year. The French owners have not yet decided whether to build their contemplated elec-

tric power transmission plant. The output from these immense deposits will in the near future be very large.

At Chirangangues the Angang Copper Company has developed large bodies of copper pyrites, but the low price of copper has prevented very energetic operations.

In Angangueo 2,000 tons monthly of silver-bearing iron pyrites have been mined, carrying over 20 ounces silver per ton, 8 per cent zinc

amined with a view to purchase, by a Philadelphia corporation, but the deal was not consummated.

In Zimapan considerable work has been done in the silver-lead carbonate and copper properties, an English company having been bought out by Colorado capitalists.

Conclusion.

The cost of power throughout Mexico is extremely high in nearly all the mining centers, as

The absence of labor troubles and the cheapness of mining in Mexico, as compared with the United States, are perhaps causes of the great prosperity which the mineral industry has enjoyed during 1902.

The immense amount of American and foreign capital now coming into the Republic shows very clearly the confidence of the world in the future stability of political conditions in the country.

It would appear to me safe to say that there are more prosperous mining camps in Mexico than in any equal area in the world, and that the opportunities for profitable mining investment on a small or on a large scale are better to-day in Mexico than anywhere else.



PROSPECTING IN THE DESERT.

blende, with some galena and 30 per cent sulphur. This ore was formerly roasted in open heaps and shipped as an iron flux to Aguascalientes, but the crude ore is now shipped to the same point and used in the copper plant.

Territory of Tepic.—At La Yesca the siliceous lime manganese ores carrying 40 ounces silver and 0.3 ounce gold have been treated successfully by roasting with salt and cyaniding. The erection of a large plant is now under consideration.

State of Puebla.—The pyritic deposit of basic silver gold zincy copper ore at Tezuitlan has been actively worked throughout the year, and large profits have been made since the erection of the smelter towards the end of 1901.

The ore is now being smelted at the rate of 5,000 tons per month, and the copper matte converted into blister copper on the ground.

Power is obtained from a water fall 1,000 feet in height, and transmitted 5 miles to the mines and smelter.

Territory of Baja California.—Renewed activity is taking place in the gold mines of this territory, and in 1902 large profits have been made in the Ensenada country. The scarcity of fuel and water is a great drawback. The Boleo Copper Company of France ships 10,000 tons of copper matte yearly and is making large profits.

State of Hidalgo.—The Pachuca mines are still producing large quantities of ore—more than 7,000,000 ounces of silver being treated annually.

The amalgamation of the Santa Gertrudis Mining Company and the Guadalupe mill has attracted much attention locally. The installation of the electric power plant some years ago from a distance of 21 miles has been of great advantage to the camp, and fair profits have been made by the operators.

The patio process has perhaps reached its highest efficiency in this camp, 90 per cent of the silver and 20 per cent of the gold being extracted from ores assaying 25 ounces silver and 0.08 ounces gold per ton. The rise in the costs of treatment for reasons already mentioned, however, during 1902 points to its early abandonment, even in this district where the process was first used. One of the large properties, controlling one-third of the mines of the district, was ex-

the Republic suffers from a chronic scarcity of fuel. The extension of the railroads, the development of the Coahuila coal-fields, the proximity of the Beaumont oil-fields and the removal of the duty from crude oil has helped, and will help, mining and metallurgical operations. The tapping of the coal-fields in the Indian Territory by the Stillwell

IRON AND STEEL IN 1902.

By FREDERICK HOBART.

The iron and steel trades of the United States during 1902 showed a demand and a production which exceeded those of 1901. The enormous production of that year was not only equaled but exceeded. Moreover, large as the production was, it did not come up to the demand, and the output of our own furnaces had to be supplemented by imports to an extent which has not been equaled for many years.

Iron Ore.—While full details of the production of iron ore are not yet available, we estimate that the total output of the mines for the year amounted to 34,814,000 long tons. Over 80 per cent of this came from the mines of the Lake Superior region, which exceeded all past records. The details of their operations are given below, and shows that the total quantity of ore taken from them and shipped to market, making allowances for rail movement, was 27,550,000 tons. Of this, more than half came from the Mesabi range, and over 2,000,000 tons from the Vermilion, the balance coming from the old ranges which showed a power of increasing their production which



ALTMAN. THE HIGHEST MINING TOWN IN THE U. S.

Railroad from Kansas City through Chihuahua, the extension now under construction of the Central Railroad to the Pacific Coast at Manzanillo, and the opening of the Sonora Anthracite coal fields, will materially improve conditions in the near future. The development of the Tampico oil-fields and the use of gaseous fuel, also tends to reduce cost, but the steady fall in silver has a contrary effect. In the vicinity of most of the old mining districts on the Mexican plateau the forest fuel has been entirely exhausted, and the utilization of water powers known to exist, is daily receiving more attention.

must have surprised these prophets who predicted the early exhaustion of these mines not many years ago.

The other chief item of iron production is found in the South. The total iron ore mined in Alabama approximated 3,500,000 tons, and the output from Virginia, West Virginia, Tennessee, Kentucky and Georgia, brought the total Southern production up to about 5,900,000 tons. The remainder of the iron ore mined in 1902 came from scattering districts in New Jersey, in Eastern Pennsylvania, Ohio, Indiana and other States.

Not all the iron ore mined during the year

was used, however, the stocks on the Lake docks at the close of the shipping season showing a large increase over those reported at the end of 1901. It is probable, however, that the operations of the winter will reduce these to about the normal figure at the opening of the next shipping season.

In addition to the ores mined in the United States, a considerable supply came from abroad. Estimating the month of December, the quantity of iron ore imported was 1,198,000 tons. About 60 per cent of this ore came from Cuba, the other sources of supply being Spain, Newfoundland and the Michipocoton Range in Canada. Cuba, however, remains, and is likely to continue in the future, the chief source of our imported mine ores. Most of these imports naturally go to furnaces on the Atlantic Coast or in Eastern Pennsylvania and New Jersey.

Pig Iron.—The production of pig iron in 1902 showed an increase of over 11 per cent beyond that of 1901, and was almost exactly double that of 1896, showing a growth in six years which has been unexampled in the history of the trade. The following table shows the output of 1902 compared with that of the previous year. For the first six months the figures are those collected by the American Iron and Steel Association. For the second half of the year the output has been estimated on the basis of the weekly capacity of furnaces in blast. In doing this, some allowance has had to be made for necessary stoppages and delays caused by insufficient supplies of fuel, as will be noted hereafter.

	1901.	1902.	Changes.
First Half	7,674,613	8,808,574	I. 1,133,961
Second half	8,203,741	8,932,000	I. 728,259
Total	15,878,354	17,740,574	I. 1,862,220

In the following table we have given the production of iron classed according to grades and the purposes for which the iron was intended. In this table the division for the second half of the year is made on the same basis as that shown by the official returns for the first half.

	1901.		1902.	
	Tons.	%	Tons.	%
Foundry and forge ..	4,541,250	28.6	5,091,545	28.7
Bessemer pig	9,596,793	60.4	10,289,533	58.0
Basic pig	1,448,850	9.1	2,128,869	12.0
Spiegeleisen and ferromanganese	291,461	1.9	230,627	1.3
Total	15,878,354	100.0	17,740,574	100.0

The changes in the totals and in the proportion of each class of iron are shown below:

	Tons.	%
Foundry and forge iron	I. 550,295	I. 0.1
Bessemer pig	I. 692,740	D. 2.4
Basic pig	I. 680,019	I. 2.9
Spiegeleisen and ferromanganese	D. 60,834	D. 0.6
Totals	I. 1,862,220	...

From this table it will be seen that over 71 per cent of the production of iron is intended for conversion into steel. It is evident, however, that the grading is defective to a certain extent, and that a considerable portion of that classed as foundry and forged iron, finds its way into the open-hearth furnace. A part of this uncertainty may be due to carelessness in grading, but a part is also the result of the greater demand for steel, and its continued substitution for wrought and cast iron, which has been manifested through the year, as indeed for several years previous.

In addition to the great production shown in our tables there was an important increase in iron brought from abroad. During the later months of the year, imports were on a very considerable scale, and over 500,000 tons, chiefly from Great Britain and Germany, came to this country. These importations served a very good purpose in relieving pressure from our manufacturers for raw material and easing the market at a time when there was almost danger of an iron famine. The following table shows the approximate consumption of pig iron in the United States during the past year, and it will be noted that the

increase was over 15 per cent, or a still higher ratio than when shown by production.

	1901.	1902.	Changes.
Production	15,878,354	17,740,574	I. 1,862,220
Imports	62,390	541,000	I. 478,610
Total supply	15,940,744	18,281,574	I. 2,340,830
Exports	81,211	28,500	D. 52,711
Consumption	15,859,533	18,253,074	I. 2,393,541

In this table the stocks on hand at the close of each year have not been included, as they were practically a negligible quantity. At no time during the year were the stocks reported unsold, equal to more than two or three days' production of the furnaces—in fact, a very large proportion of the output was under contract long before the furnaces were able to deliver it.

The exports of pig iron, which rose to their highest figure in 1900, and which at that time promised to develop into a considerable trade, have naturally fallen off under the influence of the enormous home demand. In 1901 they showed a considerable falling off from the previous year, and in 1902 the quantity was inconsiderable.

Doubtless our production of pig iron in 1902 would have exceeded 18,000,000 tons, but during the last quarter of the year, many of the furnaces in the Pittsburg District and in the Mahoning and Shenango valleys were restricted by the difficulty in securing sufficient supplies of fuel. Deliveries of coke were delayed by the inability of the railroads to furnish cars and motive power enough to move all that was required. In many cases it became necessary to bank furnaces for a time, and a few were obliged to shut down altogether, while at the best, production became irregular and few stocks were able to run up to their full capacity. This condition of affairs still continues as the year closes. It is not probable, however, that with the large supplies of Lake ore on hand that there will be any serious difficulty except in the matter of fuel.

We may add that the year closes with the furnaces in the Central West generally sold up in advance for nearly three-quarters of 1903, while the production of nearly all the Southern furnaces has been contracted for over the first half of the new year.

Steel.—No official figures are as yet available for the production of steel during the year, but estimating it on the same basis, as in 1901, it is probable that the total amounted to 15,100,000 tons, of which approximately 9,500,000 tons were bessemer or converter steel; 5,900,000 tons open-hearth, and the remainder crucible and other special steels. There was undoubtedly a considerable gain in the production of basic open-hearth steel, nearly all the additions to our manufacturing capacity having been basic furnaces. The bessemer steel, however, was practically all made by the acid process, the basic converter being still neglected in this country. The division of the steel output remained practically unchanged, bessemer steel exclusively being used for rails, while the open-hearth product finds growing employment in the manufacture of bars, merchant steel and structural material.

The consumption of iron and steel in the United States continued throughout the year to be on a scale altogether unexampled in our history, as the figures given above will indicate. In fact, the year seemed to be the culmination of a continued period of prosperity. The continuance of good crops for several years, coupled with comparatively short crops in Europe, created a demand abroad for our agricultural products, which brought into the country an enormous amount of money, and furnished people with funds for building and for investment in enterprises of various kinds, which created a demand for material, showing no signs of slackening during the year. Building in all our large cities has been on an unexampled scale, and there has been a continuance of the tendency shown for several years to increase the use of iron and steel in such construction. The railroad demand which was

at one time considered the chief factor in the iron trade, is now of very much less relative importance than formerly, although the quantity actually consumed by the railroads has largely increased. This demand was very large during the year. The general prosperity of the country enabled the railroads to make renewals very freely, and to enter on many schemes of improvement and new construction in order to enable them to handle traffic more conveniently and more cheaply. This involved the use of large quantities of material, such as new rails, bridge steel and the like, while new equipment also absorbed a further quantity. The new railroad built in the United States last year amounted, according to a statement prepared by the *Railroad Gazette* to 6,024 miles, which is the largest report made for over eight years past. The steel required for this purpose, large as the quantity was, was very much less than that taken for renewals for new sidings and additional tracks on the more important lines.

The construction of electric railroads was also very active during the year, and the material required with these enterprises formed a large item of the demand. Girder rails which are generally used for these roads, in fact, were turned out by the rail mills to a quantity never before reached.

Almost immediately after the opening of the new year the rush for material began, and by the end of January the capacity of blast furnaces and rolling mills was pretty fully taken up for the first half of the year. At the same time, the rail mills were completely filled for the year, and some important orders from Mexico and South America, which were offered here, were refused, owing to the inability of the makers to fill them, and went finally to English and German mills. All through the first part of the year the demand continued large, and in February a new and more special pressure for foundry iron began. It would seem as though a number of the larger consumers had up to that time either been doubtful as to the continuance of high pressure conditions in the trade, or had been too confident of their supplies, for in that month a number of them came into the market to an extent which threatened for the time being the general demoralization. The immediate pressure, however, was averted for the time by offers of Scotch and Middleboro iron from Great Britain and of German pig, while at the same time a number of large contracts were made which filled the order-books of the furnaces for the third quarter, and in some cases went into the fourth quarter of the year. Under ordinary conditions this state of affairs would have resulted in a sharp rise of prices, and it is quite possible that this might have been carried to an extent which would for the time being have acted as a check upon consumption. The policy which the United States Steel Corporation had announced in 1901 was, however, strictly adhered to. That company refused to make more than a very slight advance in its quotations, and its influence on this point served to steady the market, and to compel the minor producers to hold back. Later in the year there were advances made to a certain extent under the form of premiums paid for early deliveries of material, but these affected only a portion of the trade, and could hardly be accepted as constituting a general advance. The United States Corporation also succeeded through its control of a considerable portion of the Lake Superior mines, in preventing any advance in the prices of Lake ore, which were fixed just before the opening of navigation on about the same figures that prevailed in 1901, and which were maintained at those figures throughout the year. The schedule of prices was \$4.25 per ton, delivered on dock at Lake Erie port, for bessemer old range; \$3.25 for non-bessemer old range, and bessemer Mesabi, and \$2.75 for non-bessemer Mesabi. The United States Corporation, also through its control of a large number of Lake vessels, succeeded in fixing

the basis of rates on the Lakes, which during the year showed less variations than for a number of years previously, but this point of the subject is fully treated in our local reports below.

Production at the blast furnaces continued during the early part of the year at a high point, and the blowing in of several new furnaces with large outputs increased the total. Later in the year the railroad difficulties affected production to a considerable extent chiefly by preventing the free delivery of coke and compelling furnaces to bank or to restrict their output. This introduced a certain element of irregularity, and reports from the furnaces were closely watched throughout the trade. By the middle of the year imports of foreign iron had begun to attain considerable proportions. The total was, of course, small in comparison with our home production, but it exceeded anything reported in previous years. These imports undoubtedly had a good effect in constituting the market, and in assuring the consumers that they could, if necessary, secure supplies of pig iron and steel billets from abroad, in case our own works were unable to furnish them.

In June a disturbance appeared in the strike of the blast furnace workers in Western Pennsylvania, the consequences of which threatened to be serious. This strike, however, was quickly settled, and did not affect the production to any considerable extent, as had been feared.

By the end of June furnace and mill capacity had been pretty well taken up for the balance of the year, a condition probably never before known at so early a date. No producers of importance were able to accept orders after that time for delivery in 1902, except in a few special lines. In some grades of sheets, in wire and in tin-plate, it was evident that the capacity of the country to absorb the material have been overestimated, and in those branches particularly, there was more or less competition among the independent producers and the mills controlled by the United States corporation. This served to keep down prices to some extent, and also to prevent the premiums for early deliveries which prevailed in most other branches of the trade. Railroad and building enterprises which had not contracted for material before this time were compelled to postpone construction until a more convenient season. Railroads were generally able to secure the supplies they needed in some shape or other, but trolley enterprises and new building suffered considerably. In structural steel especially, some large purchases were made during the latter half of the year from middlemen or others who held contracts with the mills, and in these cases a considerable advance upon the current quotations was paid.

During the last half of the year conditions remained the same. The history of the trade was a continual struggle to secure material, and to keep up with contracts for delivery, and the position was complicated by the fact that the railroads were handling an unprecedented amount of traffic in all directions, so that annoying delays and blockades were frequent. Fuel, ores and other raw materials did not reach furnaces and mills, and they were unable to clear their yards of finished material for which consumers were waiting. It is only justice to say that the leading railroad lines seem to have made every effort to put an end to this condition of affairs, and to handle their traffic as promptly as possible, but most of them seemed to have underestimated probable demands, and from every quarter there came complaints and shortage of cars and motive power. It can hardly be said that there was any improvement in this direction up to the end of the year.

One of the most important points to be considered in the trade has been the cause of the United States Steel Corporation as to the extension of its operations. During the greater part of the year the corporation was quiet in this

direction, and little was heard of any further additions to its properties, its apparent policy having been simply to round out and complete the works which it already owned, particularly by the addition of blast furnace capacity. It will be remembered that the number of blast furnaces owned by the big corporation on its first organization was not sufficient to supply its steel works with pig iron, and the consequence was that heavy purchases of pig iron had to be made from time to time. This outside buying was chiefly done from the Bessemer Steel Association, the organization of the blast furnace operators of the Mahoning and Shenango valleys in Western Pennsylvania and Ohio. Apparently the corporation did not intend to enlarge the number of its plants or possibly postponed any such action until the settlement of the litigation in which its proposed issue of \$250,000,000 in bonds was involved. In December, however, there was a sudden change in this respect, and it was announced that the corporation had purchased the property of the newly formed Union Steel Company. The Union Company was itself a consolidation of the Union Steel Company which during the year had been constructing blast furnaces and steel works at Donora near Pittsburg, and of the Sharon Steel Company, which owned comparatively new works of the best modern types at Sharon, Pa. The purchase included the transfer of all the property and assets of the Union Company, comprising, besides the works above mentioned, large interests in iron ore on the Menominee and Mesabi ranges in the Lake Superior region, and also a large working capital which had been provided by the stockholders. The price paid was \$45,000,000, payment being made in bonds secured by mortgage upon the properties turned over. It may be said that there were special reasons for the acquisition of these properties. In the first place they gave the corporation an important addition to its blast furnace capacity. Beyond that, however, they put an end to the prospect of a serious competition in the wire and nail trades, and strengthened the United States Corporation on a side where it had been particularly weak, and open to attack. The result in this direction will probably be the closing of some of the older works of the company and the transfer of a considerable portion of the wire business of the Donora and Sharon mills. Beyond the points mentioned, however, a strong motive for the purpose is found in the ownership of the iron ore properties, but to this point reference is made elsewhere.

Another purchase reported in December was that of the property of the old Troy Steel Company located at Breaker Island on the Hudson River near Troy, N. Y. This property, which had been operated for a number of years with various fortunes, but which had been idle for several years past, included three blast furnaces having a yearly capacity of 160,000 tons of pig iron, with rolling mill for structural material, merchant steel and sheets and a basic bessemer steel plant, for a long time the only one of the kind in the United States. This property was sold some months ago to parties who incorporated a new company known as the Troy Steel Products Company, and announced plans for starting up the mills and adding tin-plate and wire mills. This project, of course, comes to an end with the sale. The furnaces when in operation used magnetic ores from the neighborhood of Crown Point, and Port Henry on Lake Champlain, making a basic pig. It is probable that the chief object of this purchase is that it provides blast furnaces, and can furnish basic iron for the open-hearth steel furnaces of the big wire works at Worcester, Mass. It is understood that the bessemer plant will be given up and the mill machinery probably transferred to some of the Western works of the company.

These purchases have given rise naturally to reports of others. It was said that negotiations

had been begun for the purchase of the Jones & Laughlin Steel Company, of Pittsburg, and the Cambria Steel Company, at Johnstown. These rumors, however, have been denied in such fashion that the denial may be accepted as final. It is said also that negotiations are in progress for the purchase of the Clairton Steel Company, which has three blast furnaces and an open-hearth steel plant under construction at Clairmont, Pa. As to the truth of this last report, there may be some doubt, especially as it has been understood that the new company was controlled by the Crucible Steel Company of America, and that the output of its furnaces was to go probably to that company.

Another report, which seems, in view of the general course of the corporation to be based upon probable facts, is that negotiations are well advanced for the purchase of the important interests on the Mesabi iron range, owned by the Hill or Great Northern Railroad interest. From the beginning, it has evidently been the intention of the Steel Corporation to control the Lake Superior iron ore deposits and no opportunity has been lost of strengthening its hold upon them. The purchases made by Mr. Hill were intended chiefly to give the traffic of the mines held to the Eastern Minnesota road, owned by the Great Northern Company, and this object could be quite as well secured by a contract with the United States Corporation as by the actual ownership and operation of the mines, while it would doubtless be financially better for the railroad. In this connection it may be well to mention the fact that there have been a good many transactions in iron properties in different parts of the United States made during the year. Most of these have been completed in a quiet, not to say secret way, and in most of them the actual purchasers remained more or less a mystery. Under these circumstances, it is not at all out of the way to surmise that the United States Steel Corporation is back of many of these transactions, and that its ultimate object in them is to control the iron ore output of the country.

Other reports, however, which have been current from time to time as to the consolidation with the big corporation of some important Southern company, such as the Tennessee Coal, Iron and Railroad Company, may be dismissed for the present as without foundation.

The exports of iron and steel, including machinery, from the United States in the eleven months ending November 30 were valued at \$90,136,024, against \$94,112,782 in the corresponding period in 1901, and \$119,604,848 in 1900. The decrease in 1902 has been due chiefly to the heavier domestic demand for some of the more important articles mentioned below in long tons:

	1901	1902.	Changes.
Pig iron	75,843	26,277	D. 49,566
Bar iron and steel	41,770	27,907	D. 13,763
Sheets and plates	28,951	17,221	D. 11,730
Rails	303,133	67,064	D. 236,069
Structural steel	49,089	51,776	I. 2,687
Wire	79,319	91,584	I. 12,265
Nails	27,576	32,783	I. 5,207

Exports of iron ore were 87,210 tons, against 64,558 tons in 1901 and 51,383 tons in 1900.

Imports of iron and steel during the eleven months were valued at \$36,766,961, which compares with \$18,267,862 in the same period in 1901, and \$19,021,881 in 1900. The imports in 1902 have been phenomenal, and from Great Britain alone are unprecedented. The principal items are given below, in long tons:

	1901	1902.	Changes.
Pig iron	53,289	507,010	I. 453,721
Scrap iron and steel	19,039	97,361	I. 78,322
Steel billets and ingots	7,125	249,695	I. 242,570
Tin plates	67,102	53,673	D. 13,429

The decrease in tin plates was due to an increasing domestic production which has favored an expansion in our export trade.

Under the conditions of great domestic consumption export trade has naturally been neglected. We have had no pig iron to spare and

no raw steel. In different lines in which an established trade was built up some time ago—such as wire, nails, structural material and sheets, there has been little loss, and in some cases a slight gain, but in rails, which two or three years ago promised to develop into a large trade, the export has fallen to almost nothing, while orders for the Pacific Coast and for Texas have gone abroad. It is not likely that these conditions will be reversed until the present high demand at home has fallen off.

Technical progress during the year has been very much on the lines recorded a year ago, that is, it has been largely in the direction of reducing costs and intensifying production. The new blast furnaces built during the year have been generally of very large size, and provided with mechanical apparatus for charging, and with casting machines for handling the iron in all those cases where the molten iron is not run directly to the converter or open-hearth furnaces. A number of minor patents have been reported during the year, but they have been mainly in the direction which we have indicated, that for handling material, and for substituting machinery for manual labor. No material changes have been made in the different steel processes. In the United States the greatest addition to the steel making capacity has been in the form of basic open-hearth furnaces. The Thomas basic converter, so extensively used in Germany, finds no hold in this country. The same may be said of the utilization of blast furnace gases which is still confined here mainly to the heating of hot blast stoves and to the raising of steam. Its application in running gas engines, while it has been extended abroad, still remains largely in the future in this country.

This condition is what might have been expected. In periods of great production when all energies are turned to the output of as large a quantity of material as possible, proposed improvements in processes are very likely to be passed over, or to be postponed until a more convenient season.

While our own iron and steel trades showed the unexampled activity to which we have referred above, in Europe, depression and comparative inactivity has been the rule. The production of pig iron in Great Britain for the first half of the year was indeed somewhat better than in the first half of 1901, the greater part of the gain being due to a larger export trade. The partial withdrawal of American manufacturers from competition, owing to the great demand at home, left the foreign markets free from a competition which had exercised a considerable influence. Exports of iron and steel from Great Britain for the 11 months ending with November showed a material gain which came from the different European countries, from India, Japan and other Eastern countries, and from Australia and South Africa. In the second half of the year the British furnaces were materially benefited by the demand for pig iron and steel billets from the United States. In the 11 months the exports of pig iron made from Great Britain to the United States rose to the high figure of 415,711 tons, more than ten times those reported in 1901. In steel billets the gain was somewhat less, but still very considerable, the total for 1902 being 46,049 tons, or nearly four times as much as in the preceding year.

In Germany, while the finished iron and steel trade was not especially flourishing, there was a considerable increase in the production of pig iron and of steel ingots. The production of pig iron for the ten months ending October 31, was 6,917,737 metric tons, showing an increase over the corresponding period in 1901 of 400,751 tons or 6.2 per cent. Nearly all this gain was in basic pig for conversion into steel. A very large part of the increase was due to the greater demand for export, chiefly to the United States. For the ten months the pig iron exported from Germany reached a total of 270,108 tons, an

increase of 156,989 tons over the previous year, and on November 1, it is understood that there was very large commitments both in iron and steel billets in the United States.

Notwithstanding this increase in pig iron production, the imports of iron ore into Germany showed a decrease. The total for the ten months was 3,445,667 metric tons, which was 454,818 tons less than in 1901, the larger part of these imports were from Spain. For the same period the exports of iron ore were 2,370,522 tons, an increase of 378,720 tons over 1901. Most of these exports were minette ores from Luxemburg and Alsace, which went to furnaces in the adjoining section of Belgium and France.

THE BIRMINGHAM IRON MARKET IN 1902.

By Our Special Correspondent.

The conditions in the Birmingham iron market, in which may be included the entire iron region of Alabama and the adjacent States, have been extremely active throughout the year. Production has been on an unexampled scale, and everything points to a continuation of this prosperity well into the opening year. The closing weeks were somewhat quiet, but this is readily understood, as the season of stock taking and inventories was on hand.

Not a single iron company in Alabama failed to make money in 1902. These profits have not all appeared in dividends, as a large part of the money was wisely expended in improving the properties and accumulating a good working surplus.

Not only was all the iron produced during the year sold, but, in fact, many of the companies closed the year with a shortage on their contract deliveries. This was not due so much to any trouble at the furnaces as to the ore shortage which, during the last three months of the year, embarrassed the iron manufacturers considerably. Moreover, nearly every blast furnace in this section has nearly, if not quite all its product for the first half of 1903 under contract, and there has been some iron sold for delivery for the second half of the year. A great deal more could have been sold for such deliveries, but many of the furnaces were unwilling to take orders running beyond June, believing that they do better by adhering to this course.

The Southern Iron Committee has not as yet completed its figures for the shipments of pig iron, cast iron pipe, wrought iron and steel from the territory which it covers, but there is no doubt that the total will approach close to 2,000,000 tons. This territory includes besides the Birmingham District, Anniston and Sheffield in Alabama and Chattanooga, Nashville and Middleboro, in Tennessee.

An instance of the pressing nature of the demand is that the production has not at all been disturbed by the holiday season which is so generally observed in the district. The furnaces had accumulated enough ore and fuel early in the month to carry them over the period when the miners were idle. The closing quotations for pig iron are as follows:

No. 1 foundry, \$21 to \$22; No. 2 foundry, \$20 to \$21; No. 3 foundry, \$18.50 to \$19.50; No. 4 foundry, \$17 to \$18; gray forge, \$16.50 to \$17; No. 1 soft, \$21 to \$22; No. 2 soft, \$20 to \$21. Prices for the first half of the year will not fall below \$20 for No. 2 foundry, while no extensive contracts have been made running later than July 1. It is expected that iron for the second half delivery can be purchased at \$20 for No. 1 and \$19 for No. 2 foundry. All deliveries on old contracts at lower prices have now been worked off and there is little doubt that the average realized by Alabama blast furnaces during 1903 will be at least \$18, taking all grades into account.

The rolling mills in the Birmingham District have been actively employed throughout the year,

and nearly all of them have large orders on hand for 1903. The holiday stock has been unusually short on account of the pressing condition of orders. Foundries and machine shops in the district have also done exceedingly well, and open the year with abundant orders. At the Ensley steel plant work has been good and promises to be still better. The completion of the rail mill will require a large quantity of steel, especially as the plant has orders for rails which will carry well through the year. The steel, wire rod and nail mills have no room for complaint over conditions during the past year, and have bright prospects for the coming season.

New production continues to come forward, and there is no doubt that the production will be greater than ever before. The Tennessee Coal, Iron and Railroad Company will blow in an additional stack at Alice Furnace in January, and the Alabama Consolidated Coal and Iron Company will also put its Gadsden Furnace in blast. The old furnace at Rising Fawn, Ga., belonging to the Georgia Coal and Iron Company, will be rebuilt, and will probably go into blast in January. It is also said that the Southern Car & Foundry Company, a large interest in which has been taken by the Standard Pressed Steel Car Company, of Pittsburg, will erect at Wylam, near Birmingham, a plant for building steel cars, while several other new enterprises are in view.

An interesting development in the district is the reported intention of the Republic Iron and Steel Company to offer stock to its employees on easy terms of payment, and to grant them representation on the board of directors of the company. The details of this plan are not yet available, but it is stated to be very probable that it will be carried out should the employees show a disposition to co-operate.

THE CLEVELAND IRON MARKET IN 1902.

By Our Special Correspondent.

Pig Iron.—The revulsion against the highest prices of 1901, which were about on a level with those paid to-day, had spent itself by January 1, 1902, and a gradual advance set in, which continued for almost six months. Then the market began to show runaway tendencies. On January 1 basic iron was selling for \$15.75, bessemer iron was bringing about the same price, while foundry grades were selling at \$16.50. Material was scarce and deliveries very slow. By January 15 bessemer producers were refusing \$16, while the Southern furnaces advanced their prices from \$11 to \$12, Birmingham, and got a good deal of business from this territory. By the end of the month the outlook was bad for small consumers of foundry iron, who depended upon the open market to supply immediate needs.

The basic producers, who had been expecting higher prices to counteract a long suspension of operations, began about February 1 to sell iron for the future, evidently believing that the top had been reached. They sold iron for third-quarter delivery at the market price of \$17.50, Valley furnace. Before the first week in February had passed one furnace announced that it had sold up its entire supply of foundry iron for the year at current prices of \$16.50 for No. 1 foundry, Valley furnace. Such an announcement, however, seldom means more than two-thirds of the possible output, the remaining one-third capacity being reserved to accommodate old customers, to provide against emergencies or to obtain possibly higher prices.

The business for the year was mostly done before March 1, and the worst operating conditions of the first nine months came during the time the sales were being made. Early in March there was a slight set back on account of floods, which temporarily crippled the railroads. The increasing demand for pig iron advanced prices to

\$17.50 for No. 2 foundry, with premiums for immediate shipment. Toward the end of the month bessemer and basic producers began to show signs of parting company. The basic producers justified their grab-all policy by saying that they had to make up for the long idleness of their stacks. Bessemer producers began to try to curb the grasping market spirit, and the Bessemer Association held for \$16, with basic producers demanding \$17, Valley furnace. The beginning of May found foundry iron commanding \$20 in the valleys. The amount of foundry iron sold at this price for early delivery was very small. The strike of the hard coal miners did not affect the pig iron trade for a month, but the demand of furnace workmen in the Mahoning and Shenango valleys, and at some furnaces in Southern Ohio and the Pittsburg District for an 8-hour day instead of 12, with no change in wages, caused a strike of a week's duration early in June. It was settled by a 10 per cent increase in wages. Demand was now so near supply that an order for 100 tons of foundry iron had to be divided among three furnaces in the South, the price paid being \$16.50, Birmingham. For immediate shipment foundry iron was bringing \$22.50, and an offer of \$20 for bessemer iron in this market failed to get a car-load. This represented conditions up to July. Foundry prices were up to \$21 for third quarter delivery with bessemer holding at \$21.75. When the strike was over and the men returned to work with a 10 per cent advance in wages, the bessemer and basic producers found trouble ahead, production began to decline and consumers to suffer. There was a demand for material for delivery during 1902, and the first quarter of 1903. Bessemer iron for first quarter delivery sold at \$16.50.

The strike of the miners in the Pocahontas District and the resulting coke shortage shut down 12 furnaces in the Southern Ohio District and some near Pittsburg District. By August foundry iron for immediate shipment commanded \$24 and \$25, with buyers eager to get it, and by September sales of foundry grades were developing for the first quarter of 1903. Prices for immediate shipment climbed higher and higher, until foreign producers were able to ship to the Mahoning and Shenango valleys and the Pittsburg District. Early in October foreign iron began to arrive, and to the end of the year the needs of the market not supplied by contracts were met very largely by importations from Scotland and Nova Scotia. The demand for foundry iron advanced prices to \$27 and \$28 for immediate delivery. The shortage in car supply was so bad during October that some stacks were idle ten days out of the thirty, and the supply of coke shortened until in November some furnaces were idle 20 days out of 30.

It was evident that furnaces would have to carry over into 1903 the greater part of many orders taken for delivery during 1902, and that deliveries on such contracts will hang on, most likely, until April 1. The remarkable season of 1902 closed with foundry iron sold up for the first half of 1903, with some sales made into the third quarter, the first half prices being \$23, Valley furnace, and those for the second half being \$21, Valley furnace. Members of the Bessemer Association have sold up their material for first quarter delivery. The non-association furnaces have sold bessemer for the first half and a good deal for the second half at \$23 prior to July 1, and \$21 after that date. During 1902 25 new furnaces were started in this region tributary to the Lake Superior ore supply, each of which will produce, on the average, 400 tons of pig iron daily. Many of them will be in service by April 1, 1903, and more by the first of July. This promises material relief for consumers at least during the latter part of 1903.

Bar Iron and Steel.—The year opened with bar iron weak at \$1.50 cents, Pittsburg, and about the same relation between supply and demand as at

present. Bessemer steel bars were 1.50 cents, with the usual \$2 difference for open-hearth. There was an advance the first week in February to \$1.60 for bar iron, while steel bars remained unchanged. By March 1 the bar iron mills had forced prices up to 1.70 cents. The result was an establishment of a price of 1.60 cents, Pittsburg, for bessemer, with open-hearth bringing 1.70 cents, Pittsburg. Early in May bar iron climbed to 1.80 cents, where it remained for the summer. Billets became scarce, but after a while producers of bessemer steel bars began to substitute them for iron bars and the situation was relieved. Shortly after tin plate mills suspended operations, throwing a good many steel billets upon the open market. Between bessemer steel bars on one side and the competition of bessemer billets on the other, the bar iron producers after August 1 found some difficulty in marketing their product at a profit. It was later in the season before any reduction was made, and mills intimated that prevailing market quotations might be shaded on very choice specifications, but the nominal prices established in May of 1.80 cents for bar iron and 1.60 cents, Pittsburg, for bessemer, and 1.70 cents, Pittsburg, for open-hearth, prevailed at the end of December.

Sheets.—Prices started in 1902 as they closed at 3.10 cents to 3.25 cents for No. 27, the basis for the other gauges. The first week of January showed that stock men were preparing for a coming rush. Prices advanced sharply by January 15, the sheet sales being on the basis of 3.35 to 3.50 cents for No. 27, out of stock, with mill sales at a lower price. Selling continued active through February and well into March. By March 15 jobbers demanded and received 3.40 cents to 3.55 cents for No. 27. Prices again advanced, and before April 1 No. 27 was quoted at 3.45 cents to 3.50 cents, out of stock. In this trade as well as in many others, probably the greater part of the business for the year was done at moderately low prices. By May 15 producers of sheets began to feel the general shortage of steel. In March a convention of the sheet mills, independent of the United States Steel Corporation, had determined to send a representative abroad. W. F. Bonnell, of Cleveland, was chosen and spent three months in England, Germany and Belgium looking for material. An order was placed and imports began about the middle of June. It looked for a while as if outside mills would have to suspend because the Steel Corporation would not release billets and sheet bars. With importations of material the home market eased up considerably, and there has been no such shortage since.

To the end of the year there was a marked difference between the heavier and the lighter grades, the heavier indicating a buoyant demand for material while the lighter grades showed indications of over-production. By July 15 the smaller mills which were looking for business were reported cutting prices, but there was no open cutting till September, then the market dropped and struck what seems to be the bottom price for material out of stock as the January basis, of 3.10 cents to 3.20 cents for No. 27 was re-established. The question arose with the cut in prices whether the Steel Corporation was not trying either to drive its smaller competitors out of business or force them into a combination where they could be more easily controlled. Many such producers, not able to have their own mines, blast furnaces, steel mills and rolling mills, are at the mercy of producers of billets and bars. The year was one of policy making, and during it the policy of making the supply of material at all times equal to the needs but not in excess of them, was introduced. The present need is as strong as a year ago, and a revival after January 1 may be expected.

Plates and Structural Material.—The year hardly showed a waver in the heavy steel trade. It opened with large stocks of both structural shapes

and plates on hand. Early buying was heavy and continued good all the spring, with no distress until April, Jobbers by February 15 were getting 2.25 cents for all grades, with demand rather brisk. The March floods hampered the steel mills considerably, and lessened production for a couple of weeks. The demand for shapes increased, and prices began to range between 2.25 cents and 3 cents out of stock. By the latter part of March speculators thought to get a lead on the future by buying heavily, but the mills gave immediate notice that no material should be sold to speculators on any pretext whatever. This policy was followed through the year. By May 1 the structural consumers began to inquire abroad for material, and it seemed as if ship-building in some of the lake yards would have to await the arrival of foreign steel. Under such conditions the smaller mills got restless. They could not see how they were to be helped by conservative prices, and were inclined to break away from the old quotation of 1.60 cents, Pittsburg. They began to talk premiums, particularly on plate, the demand for which was very heavy. The mills in this territory were sold up for months ahead, and Eastern mills were sold pretty well up to the limit of their capacity. The latter part of May saw the smaller structural mills breaking away from the larger ones on prices for spot shipment. The larger mills had very little to sell, but sold what they could at 1.6 cents, Pittsburg, the old price. The Eastern structural mills jumped prices to 2.25 cents to 3 cents for spot shipment, offering considerable quantities. This brought mill and job sales to the same level. By the second week of June the plate pool had been suspended, and the smaller mills refusing to be governed by the conservative price policy, were selling for what the market would stand. They began to demand 1.80 cents and 1.90 cents at the mill, while the mills in this territory producing structural shapes began to ask 1.90 cents at the mill. It is perhaps fortunate that most of the business for 1902 was done before this premium policy was adopted, although the small mills had all they could do to supply home needs at the higher prices.

About July 15 importations began and helped out smaller consumers a great deal. The market settled, structural steel bringing 2.50 cents to 3 cents out of stock, or from the smaller mills, with both sheared and universal mill plates bringing 2.50 cents, out of stock, and 2 cents to 2.10 cents at the mill. When the readjustment of prices came in December the smaller mills asked 2 cents for plates, while the jobbers asked 2.25 cents for sheared and 2.50 cents for universal. Jobbers held for 2.25 cents for structural and smaller mills in some instances dropped to 2.75 cents. The year ended with the large structural mills sold up for the first three quarters of 1903, and plate mills sold up for the entire year.

Steel Rails.—The 1902 price policy of steel rail mills was decided early in the fall of 1901 and before the close of that year almost the entire output for 1902 was sold. 1902 was about half over when sales for 1903 delivery began, and were heavy until the latter part of the year. It seems altogether possible that all the rails that can be produced and used during 1903 have been sold. The price was the same as the previous year, \$28 at the mill. The only fluctuation in prices came about October 15, when there was some demand for light rails, and prices went to \$38 and \$42 for immediate shipment.

Iron Ore.—Sales of ore and the chartering of vessels to carry it down the lakes, developed later in 1902 than in any season for some time past. The opening of spring found iron ore producers still undecided as to a price policy for the season. The old range operators demanded a stable list of prices, and felt that they ought to obtain a better price for their product in view of its increasing scarcity. The Mesabi producers were strongly inclined to advance prices and

make a general grab for all they could get; at the same time they showed a desire to increase profits by bearing lake freights. It was generally believed that the time had come for an ore pool to regulate prices and output. A general survey of the field, however, soon showed this idea to be impracticable. The old range men therefore accepted the price of the previous year, \$4.25 for bessemer grades, while the Mesabi range men put up their price on bessemer Mesabi 50 cents to \$3.25, and on non-bessemer Mesabi to \$2.75, non-bessemer old range, taking the same price as bessemer Mesabi. While there was no agreement as to prices the individual announcement of each company was on this basis, and it lasted through the year.

Prices having been settled, heavy buying began. Despite supposed stocks of ore in the East, some furnaces in that region bought largely, a conservative estimate of the amount taken being between 2,500,000 tons and 3,000,000 tons. Sales to Eastern consumers continued through the year, and as many were on the continuing contract plan, with material to be distributed through several years, it is extremely difficult to say just how much ore was sold there for this year's consumption. New furnaces to go into operation on Lake Superior ore during the first half of 1903 will give an increased consumption of 7,000,000 tons, but none will be ready for operation until April 1, and most not before July 1. The fact that Eastern ore supplies were insufficient this year indicates that shipments of Lake Superior ore to Eastern furnaces will increase and producers are already talking of considerable advances in ore prices for 1903.

Lake Freight Rates.—Last spring the vessel interests headed by J. C. Gilchrist, the biggest independent vessel owner, made a vigorous stand for an 80-cent rate from Duluth to Ohio ports, with a commensurate rate from the other shipping ports, opposing the allied ore shippers headed by the United States Steel Corporation. The Steel Corporation learned that one of its larger competitors had been able, through the influence of M. A. Hanna & Co., to make a 75-cent rate in 1901, which carried provisions for 1902 as well. The supply of tonnage indicated that 1902 was to be a season of low rates, and the Steel Corporation did not like to be worsted by a competitor. The result was that while some shippers paid 80 cents on about 1,500,000 tons of ore, the great bulk was chartered under contract at 75 cents.

The season opened with going rates identical with contract rates, and prospects of a fight over going rates through the year. Some vessel interests refused to handle anything but wild ore rather than take the proposed smaller rates; unfortunately for them the season opened sear. Almost the entire fleet of the United States Steel Corporation was in operation by April 10, before contract rates for the season had been determined. The outside vessel men had hoped that boats would not start before May 1. The sudden opening of navigation and the movement of 1,500,000 tons of ore before the vessel men expected any ore to be delivered at all, upset plans generally. In round numbers it has been figured that the amount of ore handled over Lake Erie docks was 22,640,000 tons, as against 17,014,000 tons for the season of 1901, an increase of 5,635,000 tons. The amount which remained on the docks December 1 was 7,074,250 tons, as against 5,859,653 tons on December 1, 1901, an increase of 2,214,601 tons. The generality of boats in 1902 made an average of 20 trips for the season, whereas the lowest average heretofore was about 22 trips, a decrease of 11 per cent. Had the car shortage been responsible for vessel delays the amount of ore moved from the lake docks to furnaces would not have shown such an abnormal per cent of the total increase handled. The amount of ore moved shows that the railroads did extraordinary work. Ore shippers had no reason to complain of lack of cars or poor dock

equipment. In one instance a new automatic un-loader handled 5,600 tons in five hours and 15 minutes, 92 per cent of the cargo being taken out automatically. Nor can blame for delays be placed on dock conditions since the entire year was free from labor difficulties.

The hard coal strike immediately threw vessels loading anthracite at Buffalo and Erie to the bituminous shipping ports. These boats not finding their usual number of up-bound cargoes began going back to the head of the lakes light and rushing down ore. The result was a general congestion at lower lake docks, which lasted about all summer. The expected importations of ore from the Michipocoten ore fields in Ontario were estimated at 1,000,000 tons. Instead they perhaps have reached 200,000 tons, an increase of 60,000 tons, or 10 cargoes, over 1901. The increased demand for ore in Canada, the partial failure of some projects there and the inferior grade of the ore may have had something to do with keeping down importations.

The following tables, prepared by the Cleveland *Iron Trade Review*, shows the performances of docks at the head of the lakes. The rail shipments for 1902 are estimated:

	1901.	1902.	Changes.
Escanaba	4,022,668	5,413,704	I. 1,391,036
Marquette	2,354,284	2,595,010	I. 240,726
Ashland	2,886,252	3,553,919	I. 667,667
Two Harbors	5,018,197	5,605,185	I. 586,988
Gladstone	117,089	92,375	D. 24,714
Superior	2,321,077	4,180,568	I. 1,859,491
Duluth	3,437,955	5,598,408	I. 1,160,453
Total by lake	20,157,522	27,039,169	I. 6,881,647
Total, all rail	431,715	500,000	I. 68,285
Total shipments	20,589,237	27,539,169	I. 6,949,932

The following shows the amount handled over Lake Erie docks, and those still remaining there in stock:

Iron Ore Receipts at Lake Erie Ports. Gross Tons.

Ports.	1901.	1902.	Changes.
Toledo	798,298	1,037,571	I. 239,273
Sandusky	33,017	165,556	I. 132,539
Huron	431,311	520,646	I. 89,335
Lorain	721,662	1,442,417	I. 720,755
Cleveland	3,831,060	4,873,318	I. 1,042,258
Fairport	1,181,776	1,538,744	I. 356,968
Ashtabula	3,981,170	4,796,805	I. 815,635
Conneaut	3,181,019	4,300,301	I. 1,119,282
Erie	1,379,377	1,717,268	I. 337,891
Buffalo & Tonawanda.	1,475,386	2,256,798	I. 781,412
Total	17,014,076	22,649,424	I. 5,635,348

Iron Ore on Lake Erie Docks, Dec. 1, Gross Tons.

Ports.	1901.	1902.	Changes.
Toledo	254,196	310,023	I. 55,827
Sandusky	47,384	95,175	I. 47,791
Huron	231,501	252,704	I. 21,203
Lorain	195,863	328,304	I. 132,441
Cleveland	1,378,060	1,500,604	I. 122,544
Fairport	710,590	924,236	I. 113,646
Ashtabula	1,769,145	1,967,136	I. 197,991
Conneaut	604,106	673,679	I. 69,573
Erie	470,718	722,966	I. 252,248
Buffalo	198,100	319,367	I. 121,267
Total	5,859,663	7,074,254	I. 1,214,591

The proportion of direct shipments of ore to furnaces over the Lake Erie docks is very large. Shipments to furnaces between May 1 and December 1 of this year aggregate 18,423,364 tons, compared with 14,204,596 tons in 1901, 11,613,773 tons in 1900, 11,765,158 tons in 1899 and 9,058,829 tons in 1898. It will thus be seen that the direct shipments have more than doubled since 1898.

The shipments to furnaces during the navigation season above referred to are determined in this way: First, we have the amount of ore on Lake Erie docks before the opening of navigation on May 1, last, 2,848,194 tons; add to this the receipts of the season just closed, 22,649,424 tons, and the total is 25,497,618 tons; deduct the amount now on dock, 7,074,254 tons, and we have 18,423,364 tons as the amount that was forwarded, either direct or from dock, to the furnace yards.

It is understood, of course, that the difference between the output of 27,039,169 tons from the mines and the receipts of 22,649,424 tons at Lake

Erie ports, is ore that went to places other than Lake Erie ports, principally the furnaces at South Chicago.

THE PITTSBURG IRON AND STEEL MARKETS.

By Our Special Correspondent.

The policy of the United States Steel Corporation to prevent prices from soaring to an abnormal figure with every increase in demand was successfully carried out, and as a result the iron and steel market was steady and substantial throughout the year. Buyers had more confidence than in former years, and orders for extended future delivery were freely placed. Before the end of the first quarter the mills had business on the books insuring steady operation for months ahead and the furnaces soon were filled up for the second quarter. The tonnage for the year just closed was greater than any previous year in the history of the iron and steel industry, prices and profits were more satisfactory, but deliveries were extremely aggravating. Pig iron production would have been much heavier but for the shortage of coke. The fact that the railroads were wholly unable to handle the freight offered despite the increased facilities by heavy additions to rolling stock and improved equipment, indicate an unprecedented business. Building operations were delayed, although the material needed was ready, but could not be shipped. The furnaces suffered greatly during the last half, as it was impossible to get the full requirements of coke, and as a result a heavy tonnage booked for shipment during 1902 was carried over into this year. Mills were affected by a shortage of iron, and at times by a scarcity of coal. The plants of the big Steel Corporation, except tin-plate and sheet mills, in the Pittsburgh District and the Youngstown District, were kept in constant operation throughout the year, only closing for brief periods for necessary repairs.

The only weakness in the market was in sheets, tin-plate and wire products. Reductions in price were found necessary by the Corporation in order to secure business. This condition of affairs, however, as is known, is due to the excessive producing capacity in these lines. The demand was greater than the previous year, but last year many new independent plants were put in operation. Before the opening of the second half there was a heavy overproduction in tin-plate and many mills were forced to close. In order to keep its plants in operation the American Tin-Plate Company succeeded in getting a wage concession from the workers and went after the rebate export trade. A cut in prices from \$4 to \$3.60 a box also was made, but it was late in the year before enough business was secured to warrant the starting of all of the idle mills. Wire products were cut in price \$7 a ton, and the plants all were operated steadily. In sheets a cut of \$5 a ton was found necessary to insure business for the mills, many of which had been shut down for lack of orders. The independent plants were not closed by these cuts, as most of them had contracts taken at favorable prices, and had fully provided for the raw material required. While the conditions in these lines appear to have been unsatisfactory the business done, it is estimated, was much heavier than in former years.

The apparent dullness in tin-plate, sheets and wire was almost lost sight of in the tremendous business done in structural material and other finished steel products. Every plant in this district was crowded with orders throughout the year, and a heavy business was booked for this year's delivery, insuring continuous operation up to July 1. Some high prices were paid for finished steel products during the last half, but the official price was maintained at all times by the leading interests. Business accepted at these figures, however, was for extended delivery. The

accompanying table of prices for the year merely gives the rates quoted, and does not record the prices paid, as it would be impossible to satisfactorily show the fluctuations on orders for prompt shipment. The ruling price was quoted in every instance, but premiums over these rates were paid on urgent orders, and they varied from \$2 to \$8 a ton on structural material, steel bars and plates. Importations of steel and pig iron were heavy during the last half, and it would be difficult to give a correct estimate of the tonnage. Prices in most instances were about equal to the rate for the home product. Less Southern iron was received in this district than in former years, indicating that prosperous conditions were not confined to the Pittsburgh District alone. The railroads were entirely responsible for the curtailment of the production of pig iron. Furnaces in the Mahoning and Shenango valleys were forced to bank during the last four months of the year, and a number were blown out on account of a shortage of coke. The coke supply was adequate and fully 1,000,000 tons were stocked in the yards during the last half, the railroads being unable to furnish the cars needed to transport it to the furnaces. Blast furnaces in the Pittsburgh District were not so severely affected, but the production would have been greater had conditions been better. Two furnaces were added to the Carrie group early in the second half, and in December one was

Furnace Association in April for 300,000 tons of bessemer iron for delivery in the fourth quarter of 1902 and the first quarter of 1903 at \$16.50, Valley furnaces. This price was not duplicated during the rest of the year. The strike of blast furnace workers which began on June 1 for the establishment of a three-turn instead of a two-turn system continued for a week, and production was curtailed fully 50,000 tons. A compromise was made with the strikers, and an advance of 10 per cent in wages was granted. During the last half no sales of bessemer pig iron were made for 1902 delivery at less than \$22, and some sales were made above \$24. As high as \$25 was paid for foundry iron, and the minimum price of gray forge for the last half was \$21.

The demand for steel was heavy in the first quarter, and in April large orders began going abroad, and importations of steel continued throughout the year. Heavy orders for structural material were placed in January. Early in March the mills were forced to refuse business, except for late delivery, and premiums of \$5 a ton for prompt shipment were freely paid. An effort was made by some manufacturing interests to advance the price of structural material and plates early in the year, but the big Steel Corporation objected, and the official prices announced in January remained unchanged all year. The steel rail production for 1902 was sold up before May 1 at the fixed price of \$28 a ton.

Average Prices of Iron and Steel in Pittsburgh.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bessemer Pig Iron	\$16.75	\$17.00	\$17.50	\$20.75	\$22.00	\$22.25	\$22.25	\$22.50	\$23.00	\$24.00	\$23.75	\$23.50
Foundry No. 2	16.50	17.00	19.00	20.75	21.50	22.00	23.00	23.00	23.00	23.50	23.50	23.25
Gray Forge	16.00	16.50	18.00	19.75	20.25	20.50	21.00	21.25	21.50	21.00	21.00	21.00
Bessemer Steel Billets	27.00	30.00	31.00	32.00	32.50	33.50	32.50	31.00	31.00	30.00	30.00	30.00
Sheets No. 28	3.10	3.10	3.10	3.10	3.10	3.00	3.00	3.00	3.00	2.75	2.75	2.75
Tank Plate	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
Steel Bars	1.50	1.55	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
Steel Rails	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
Wire Nails	2.00	2.05	2.05	2.05	2.05	2.05	2.05	2.00	1.90	1.85	1.85	1.85
Cut Nails	2.05	1.95	1.95	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05
Ferro Manganese, Domestic	52.50	52.50	52.50	52.50	52.50	52.50	52.50	52.50	52.50	52.50	52.50	52.50

added to the Edgar Thomson group. It is announced that notwithstanding the difficulties over the shortage of coke that pig iron production for the year in this district was about 250,000 tons greater than in 1901. Official figures, however, are not available. The freight congestion became so great in November that a tie-up of all industries was threatened. By extraordinary efforts the blockade was relieved, but transportation facilities were not up to requirements. If the mills in this district had been forced to depend entirely on the railroads for coal they could not have been operated as satisfactorily as they were. Most of the mills have facilities for obtaining a coal supply from the rivers which are always navigable this side of the Davis Island dam in the Ohio River. The Monongahela River Consolidated Coal and Coke Company was able to operate its mines continuously and ship coal to the mills. The Pittsburgh Coal Company, the railroad coal combination, estimates that production last year was curtailed fully 20 per cent, due to the inability of the railroads to handle the freight offered. This company is short over 1,000,000 tons on its contracts, and in addition was forced to reject many large orders.

The year opened with bessemer pig iron selling at \$16.75, and large contracts were placed with the merchant furnaces, the United States Steel Corporation taking 150,000 tons from the Bessemer Furnace Association. Severe weather in February crippled the railroads and interfered with shipments, and although the association had fixed the price at \$16.75, buyers forced prices up. The demand for foundry iron was remarkable, and before the end of February there was scarcely any difference in price for all grades of pig iron. Sales of foundry iron were made at prices above bessemer. Late in March buying of foundry iron for 1903 delivery began, and \$19 was the price paid. Furnaces were sold up for the first half before April 1. The United States Steel Corporation made a contract with the Bessemer

The demand was heavy, and relaying rails found a ready market at \$29 and \$30.

The flood on March 1 entirely closed or affected most of the mills in the Pittsburgh District. All flood records were broken in getting the mills ready for operation after the waters had receded, and some were started within 24 hours.

The labor troubles of the year were not of a serious character. Strikes of structural iron workers, machinists and of steel melters in the crucible steel works were soon settled by granting advanced wages to the men. The iron workers in the union rolling mills of the country got two advances. The puddlers' pay was increased from \$5.50 to \$5.75 a ton in January, and the finishers got an increase of 2 per cent. In July the puddlers were given a \$6 a ton rate, and the finishers an additional 2 per cent increase. This was due to the heavy demand and advanced prices in bar iron. These high wages continued for the remainder of the year.

The Union Steel Company and the Sharon Steel Company were consolidated in November, and in the following month the merged company was taken over by the United States Steel Corporation. The St. Clair Furnace Company and the St. Clair Steel Company, with plants at Clairton, were consolidated, and are being operated as the Clairton Steel Company by the Crucible Steel Company of America.

The beam and plate associations met in December, and renewed the agreements for another year and reaffirmed prices.

HIGHWAYS IN THE CAUCASUS.—United States Consul-General W. R. Holloway writes from St. Petersburg, November 29, 1902, that since the return of the Minister of Ways and Communications from an inspection tour of the Caucasus, it is announced that plans for building a network of narrow-gauge railroads are under

discussion. It is proposed to authorize the organization of private companies to build these roads, the Government to indorse their bonds to the amount of \$250,000,000. These highways will aid in the development of the manganese and other mines in the Caucasus.

COAL IN 1902.

By SAMUEL SANFORD.

The world's production of coal, that measure of industrial growth, shows but a very small increase for the year just closed, and revised figures may show a decrease. Labor troubles, manufacturing depression and other causes have contributed to restrict output in the great coal-producing countries of the world. These countries retain their relative rank. The United States, which passed England in 1898, has not increased its lead during 1902. Its coal-fields particularly, those tributary to the Atlantic seaboard, have been opened on such an extensive scale, and such sums have been invested in mines that its position as the greatest coal producing country in the world will probably remain unchallenged for years to come. A brief review of the year shows these facts:

Asia.—But little has been done in China, owing to the unsettled problems left by the Boxer rebellion. In Siberia the Russian Government has continued work on the mines back of Vladivostock, but generally the great continental coal-fields of Eastern Asia still await modern machinery and methods and cheap transportation to the seaboard. In Japan the mines will probably show an increase for the year. In India the coal mines increased their output and importous States will probably show a decrease.

Australia.—This continent is suffering from industrial depression due to the prolonged drought which has made a desert of vast sections of the interior. In addition the output of the coal mines has been restricted by the arbitrary policy of the labor unions. The total production of the various States will probably show a decrease.

Africa.—The various South African colonies are slowly recovering from the effects of the Boer war. A scarcity of labor and other difficulties have hampered the activity of the Witwatersrand gold mines, and restricted the demand for fuel. The mines in Natal have been very busy, and those in the Eastern part of the Transvaal resumed work. The mines have better railroad facilities, but their output is not yet what it was before the war.

Europe.—In Russia the mines of the Donetz Basin have worked about as usual during the year, and may show a small advance. The Russian production in 1901 was about 19,000,000 short tons. In Austria-Hungary, owing to industrial depression, the coal mines of Bohemia will probably show a smaller output than in 1901. In that year the total output of the Empire was about 43,500,000 short tons of coal and lignite.

France, instead of the usual 2 per cent. increase, will probably show a falling off of at least 10 per cent, making the output of the year under 32,000,000 short tons; this decrease being due, of course, to a strike of the miners, which started in October and lasted over a month.

Germany also shows a decreased output. Estimating on the returns for ten months, the total output of the Empire was 148,336,000 metric tons of coal and lignite, a decrease of about 4,000,000 metric tons from 1901. This decrease was due to the action of the syndicates which restricted the output of coal in order to maintain prices and to the working out of some lignite mines in Saxon. Belgium will probably show but a small increase, its mines constantly getting coal from greater depths, and labor troubles are impending. The output during 1902 was about 24,000,000 metric tons.

England will probably show some increase, but

its tonnage will probably be very nearly that of 1901, or about 48,000,000 short tons. About one-fourth of the output of the English mines is exported. Exports for the year show a slight increase. There was also an increase of coal shipped for the merchant marine, and an increase in the amount made into coke and used in the iron industry. There was a decrease in that used for other purposes. At some of the South Wales mines the unions, in order to keep up prices, have restricted output.

Canada.—In Nova Scotia coal mining was very active, and the mines will show an increase of at least 30 per cent over 1901, making the tonnage for 1902 the largest on record. This was due chiefly to the anthracite miners' strike in the United States, and the consequent shortage of coal along the Atlantic seaboard. A large amount of Nova Scotia bituminous was needed in Ontario to replace anthracite and shipments to Boston and other sea ports in New England, were the largest on record. In British Columbia, the mines at Fernie were tied up by a long strike, which started in May and ended in September. The strike was over a new system of keeping the men's time, and was really a struggle for recognition of the miners' union. It ended in a compromise. The total production of the province for the year is estimated at 1,731,000 short tons.

A new mine of some importance has been opened at Frank in Alberta, by J. L. Frank and associates, of Butte, Mont. The product is a good steam coal, and the mine is now producing in the neighborhood of 500 tons a day.

United States.—Coal production in the United States, so far as can be estimated from the figures now available, will show a slight increase for 1902. The great strike reduced the output of Pennsylvania anthracite about 20,000,000 long tons. A sympathetic strike in West Virginia reduced the output of that State over 2,000,000 tons. Labor troubles existed in other fields, notably Michigan, but did not seriously affect the total output. The shortage in anthracite and in West Virginia bituminous was more than made up by the activity in the Pennsylvania bituminous mines, and in the mines of Ohio, Indiana and Illinois. In these States mining was more active than ever before, and the output broke all records. The total output of the United States was 293,300,000 short tons.

Output by States.—Pennsylvania, in spite of the decrease in anthracite shipments, easily maintained its position as the leading coal producer of the Union. Production in the Pittsburgh District showed an increase of fully 11 per cent, while the output of the mines along the Pennsylvania Railroad east of Pittsburgh was very heavy, showing an increase of over 30 per cent. The total production of Pennsylvania is estimated at 45,000,000 short tons of anthracite, and 95,000,000 short tons of bituminous, a total of 140,000,000 tons.

Illinois easily maintained second place. There were no strikes during the year of any importance, and demand, owing to the curtailing of shipments from West Virginia, and the need of bituminous coal to replace Pennsylvania anthracite for domestic purposes, was very heavy. The State's production was about 31,000,000 short tons.

West Virginia, as noted above, suffered from a strike in the Pocahontas, Flat Top, Kanawha and Fairmount districts, that is, the coal-fields along the Norfolk & Western and Chesapeake & Ohio Railroads. The strikes were due wholly to a desire of the United Mine Workers to test the strength of the organization. The West Virginia miners, particularly those along the Norfolk & Western and Chesapeake & Ohio, have been imperfectly organized, and previous attempts to get them to strike had been futile. The 1902 strike was nominally for the correction of various abuses, for an 8-hour day, and for higher wages. In the Pocahontas District it was a failure almost from the start, the men gradually drifting back to work after a week's idle-

ness, and practically all mines working full handed by August. Along the Chesapeake & Ohio, however, the miners were much better organized, and the strike was longer. The men returned to work slowly in some companies granting them minor concessions, and others not granting anything at all. By October the strike was practically over and from then until the end of the year the mines worked as heavily as car supply would permit. The output was about 21,000,000 short tons.

Ohio will rank third in coal production. The miners adhered to the agreement made with the operators at the joint convention at Indianapolis in February, and the output broke all records by a large margin. It is estimated at 24,700,000 short tons. Ohio mines, like those in Illinois, benefited greatly by the strike in West Virginia and Pennsylvania, the consumption of Ohio coal for domestic purposes and industrial uses being very heavy, and a large tonnage went up the Lakes.

Alabama miners were idle only for two weeks or so in July, while a new wage scale was under consideration. During the year the demand for coal was very heavy, particularly for use in the manufacture of iron, and the State's output was the largest on record, being 10,000,000 tons.

In Indiana mines were steadily busy throughout the year, the only restriction on output being short car supply or voluntary idleness of the miners. The output was 8,357,417 tons.

Of the other important coal-producing States, Colorado showed an increase. Kentucky mines were generally very busy, only a few mines suffering from the strike started by the United Mine Workers in 1902. Iowa production increased slightly, about 3 per cent. There was a large increase in the South-western field, that is, in Kansas, Arkansas and Indian Territory. The Kansas output was 5,379,500 short tons.

Exports and Imports.—Exports of coal from the United States for the eleven months ending November 30 were as follows:

	1901.	1902.	Changes.
Anthracite	1,889,438	767,850	D. 1,121,588
Bituminous	5,043,221	4,933,821	D. 109,400
Total coal	6,932,659	5,701,671	D. 1,230,988
Coke	360,744	355,237	D. 5,507
Totals	7,293,403	6,056,908	D. 1,236,495

The coke exports are chiefly to Mexico. The decrease in exports was, of course, due mainly to the anthracite shortage.

Imports of coal into the United States for the eleven months ending November 30 were as follows:

	1901.	1902.	Changes.
Anthracite .....	.....	53,428	I. 53,428
Bituminous	1,757,788	2,181,098	I. 423,310
Total	1,757,788	2,234,526	I. 476,738

Usually nearly all the imports are made at Pacific Coast ports. This year the increase reported was all in coal received from Great Britain at Atlantic ports; brought in to make up for the short supply of anthracite.

THE STRIKE IN THE PENNSYLVANIA ANTHRACITE FIELDS.

The strike of the miners of the anthracite region of Pennsylvania was the most noteworthy struggle between organized labor and organized capital that this country has ever seen. It was remarkable for the number of men involved, the amount of capital invested in the mines and railroads affected, for its length and for the resulting widespread inconvenience and distress to the Public. The struggle was foreseen when the strike of 1900 was compromised for political reasons, with victory almost in the grasp of the mine operators. That strike, with its resulting 10 per cent increase in wages, enormously increased the power and prestige of the United Mine Workers, and whereas in 1900 not more than one-tenth of all anthracite mine workers were enrolled in the union, by 1902, probably one-half were union men. At the convention of mine workers at Indianapolis early in February, 1902, resolutions were passed promising aid to the anthracite miners

in obtaining the adjustment of wages by yearly agreement, and in getting shorter hours of labor. This action was a fair warning to the anthracite operators.

Unfortunately, it was soon seen that the operators and miners were not to fight the matter out between themselves. A notoriety hunter from Cleveland, O., got up with a blast of trumpets an organization called the National Civic Federation to act as peace-maker in all disputes between labor and capital. Its formation just at this time, however, aroused suspicion that its real object was to have a hand in any conflict between the anthracite miners and operators, since one of the principal members was a United States Senator who took a conspicuous part in the settlement of the 1900 strike. The members of the Federation comprised manufacturers, a few members of the clergy, labor union officials, including President Mitchell, of the United Mine Workers, and a sprinkling of politicians. The only member connected with coal mining was the United States Senator, previously mentioned, and he was not an anthracite operator.

The president of the United Mine Workers invited the presidents of the principal anthracite roads as well as various independent operators to be present at a convention to be held at Shamokin on March 18, at which a list of demands presented by the United Mine Workers was to be discussed. The presidents of the coal roads acknowledged the receipt of these letters, pointed out that the influence of the United Mine Workers had been to destroy discipline at the mines, and cut down the efficiency of the average miner and declined to make wage agreements with the union.

The companies on March 15 said they would continue to pay the 10 per cent advance in wages for another year, and would take up all grievances at the collieries with men at their actual employ. At the Shamokin Convention the operators were not represented; the mine workers passed resolutions, the more important being:

To demand an 8-hour work-day.

To demand recognition of mine committees for the adjustment of disputes.

To oppose working with non-union men.

To provide for the organization of all skilled mechanics in conformity with the decision of the American Federation of Labor Convention.

To favor the arbitration of trade disputes.

To favor colliery unions wherever practicable.

To provide for the systematic examination of working cards.

To oppose the contract system now in force at some collieries and to limit to two the number of laborers who may be employed by any one contractor.

To condemn the operators' system of blacklisting employees discharged by any one company.

The resolutions virtually amounted to a demand for increased wages and direct recognition of the union.

The National Civic Federation was invited to try to bring the operators and miners to an agreement. If the Civic Federation failed to effect a satisfactory adjustment prior to April 1, and if after that date negotiations were still pending, it was resolved that all anthracite mine workers, except those necessary to keep the mines in repair, would remain away from the mines, strippings, washers and breakers on Tuesdays, Thursdays and Saturdays of each week. Should a strike take place no settlement was to be made in any separate district, until the strike had been officially declared ended by a convention representing the three anthracite districts.

The National Civic Federation held conferences at New York, at which representatives of the coal roads were present about March 25, the final result being a truce of 30 days. The outlook was against a strike. The Federation later appointed a conciliation committee which met April 26 in New York, a committee of the presidents of the Philadelphia & Reading, Delaware & Hudson and Delaware, Lackawanna & Western companies, the chair-

man of the Erie and John Markle, an important independent operator. It is to be noted that the Pennsylvania Company, which operates collieries in the Wyoming region, and in the Western Schuylkill field, was not represented at any conferences the company claiming that it was not in any way connected with the so-called "community of interest," the nearest approach to a trust that exists in the anthracite coal trade. The conciliation committee accomplished little, and a sub-committee accomplished no more at later meetings; in fact, it really looked as though meetings were being held and labor leaders were going and coming largely for newspaper advertising and political effect.

Finally, President Mitchell issued an order to the United Mine Workers to remain away from the mines on May 12, and to stay out until the operators make substantial concessions. His action was to be approved by a convention at Hazleton on May 14. The miners began to quit work on May 10, and on May 12 practically all collieries in the anthracite field, some 341 in number, were idle as were something like 140,000 men. Only a few washeries kept at work.

The demand of the miners amounted to an 8-hour day, with 10-hour day pay for all men not working on contract, a 10 per cent increase for day laborers, a 5 per cent increase for contract miners, a minimum wage scale, and coal to be weighed as it came from the mines. The operators had said that the financial conditions of the great mining and transportation companies did not justify increased costs without a corresponding increase in the price of coal, and that public sentiment and the competition of bituminous coal were against higher prices. On March 14 the Hazleton Convention, by a very small majority, decided to strike, the sentiment in favor of the strike being strongest in the Wyoming field, owing to the influence of District President Nichol. It was much less pronounced in the Schuylkill Region, where the Reading Company enjoyed an inevitable reputation for treating its men fairly, had not been guilty of extortion in such details as the price of powder, and at the end of the strike in 1900, when the old sliding wage scale based on the selling price of coal at tidewater was abolished at the request of the miners themselves, had granted virtually a 16 per cent increase in wages. Some operators in the Hazleton and Wyoming regions, by reckoning a big reduction in the price of powder as part of the 10 per cent increase in wages, gave the men little or no better pay.

By June 1 the situation had cleared so far that any unprejudiced person by personal inquiry in the anthracite fields could see that the miners' demands were virtually three. The first was that all coal mined by contract in the Wyoming region should be paid by the ton instead of by the mine car. This demand was to get the Wyoming men out, since the system of payment by the mine car, though perhaps the best possible, had been a fruitful source of friction between miners and operators, and the average uneducated Slav, Hungarian or Italian is easily persuaded that a company is cheating him. The second demand was an 8-hour day for all men not working on contract. This was to get the engineers and firemen, particularly the latter, who had a union of their own, and had struck without avail in 1901, to go out. The third demand not openly expressed, but well understood, was for straight-out recognition of the union. Now, recognition of the union in the anthracite region does not mean simply a wage scale arranged by a joint convention of miners and operators. It means, as experience has amply shown, that each individual miner, driver, laborer and even breaker boy shall in all things obey the local lodge of the union rather than the mine superintendent; that no man, not a member of the union, should be allowed to work about any colliery, and that no union man shall be discharged, even for good cause, if his local lodge objects. In fact, recognition means that all question of mine discipline shall be taken away from the mine superintendent and turned over to the local lodge of the union. It is easy to understand why the operators decided to fight.

The first week of the strike was marked by some acts of violence, then both sides settled down to a trial of strength. President Mitchell issued an order asking engineers, firemen and pumpmen to quit on June 2, the object being to intimidate the operators through fear of enormous loss in flooded mines. The latter, however, secured from among their foremen, engineers, clerks, surveyors, etc., and from much unskilled labor as they were able to pick up enough men to keep the pumps running.

During July and August the strike dragged along with little change. Late in September the companies made vigorous preparations to resume mining. This instantly led to rioting, and the militia was called out. Governor Stone, however, had showed that political considerations were of far greater importance to him than the maintenance of law and order. Many acts of violence had been committed, the boycott was used against men in every calling, and virtually mob law prevailed around many collieries in the anthracite region. Handicapped by timid or partisan municipal authorities, and a weak governor, the mining companies could offer little protection to non-union men. Even the presence of the militia did not prevent arson and assassination being committed within half a mile of some encampment. Many militia men sympathized with the miners, and showed their sympathy openly.

By October 1 the shortage of anthracite all over the country was acute, the outlook favored much suffering and distress during the winter and public feeling in spite of the riotous acts of the miners was against the operators. These considerations and others suggested a compromise. Through President Roosevelt, a committee was appointed to take up all points at issue between the miners and operators. This committee, composed of Carroll D. Wright, Archbishop Spalding, Judge Gray, Gen. J. M. Wilson, E.W. Parker, T. H. Watkins and E. E. Clark was as good a choice as could be expected. This commission is still in session, has heard a great mass of evidence and will probably render a decision within the next two months. The strike was formerly declared off on October 21.

To sum up, the operators, when the strike was declared, and especially when the miners threatened to flood the mines, had right on their side. The evidence so far presented before the Arbitration Committee shows that although there were cases of hardship and suffering in the anthracite region, as elsewhere, and although some companies were guilty of petty tyrannies, the miners, as a rule, were well paid for their labor and the strike was precipitated by the union leaders whose apparent aim is to control absolutely coal mine labor in the United States. Such control would secure for the higher officials of the union power in excess of that held by the Governor of a State. As to John Mitchell, whatever may be said of his acts, he has shown himself a leader of men. Doubtless he condones the misstatements in his addresses to the public, all acts of violence committed by members of his union, and the complete overthrow of constitutional law in the anthracite regions on the ground that "the end justifies the means." In contrast to his leadership the policy adopted by the operators shows lack of foresight. Fearful of precipitating violence, mistakenly believing that inaction would eventually tire the miners, they allowed things to drift until the real victim of the strike, the public, insisted that something be done. Had the operators even before the strike started, showed not once but at every opportunity what the union had done and was trying to do; had they discounted every public statement by Mr. Mitchell by calling attention to actual conditions in the anthracite fields and the average earnings of miners; had they made the most of every act of violence and finally had they used every means to secure evidence that would convict all mine workers guilty of arson or assassination, the strike would not have lasted so long, nor would it have been settled by compromise. As to the politics behind the struggle, that is something of which the public knows little, nor is the matter likely to come before the Arbitration Commission. It is enough to say that behind what the

public saw was a vast network of intrigue and trickery. Trade union politics, State and even semi-national politics were involved. Those political leaders who for purely selfish reasons favored one side or the other, as occasion offered, are responsible for much of the needless loss, inconvenience and even suffering caused by the strike.

THE ANTHRACITE COAL TRADE IN 1902.

The year 1902, like the year 1902, will long be memorable in the history of the anthracite coal trade, but whereas 1901 was noteworthy for a record-breaking output and sustained prices, making the year extremely satisfactory to producers, 1902 will always be known as the year of the great strike which cut down output for months, caused a loss of fully \$15,000,000 in net earnings to railroad companies, deprived industrial concerns and families of needed fuel and caused widespread inconvenience and complaint. It was the controlling factor in the trade from its start on May 10 until finally declared off on October 18, and its influence on prices is still felt, and will be until next spring. A detailed review of this remarkable struggle has already been given in another column. The effects of the strikes of 1900 and 1902 on production are shown by the following table, showing the shipments by months, December, 1902 being estimated. The figures are long tons:

	1900.	1901.	1902.
January	4,482,041	4,468,875	4,392,770
February	3,188,180	4,016,010	3,990,559
March	3,133,896	3,232,762	4,072,189
April	3,364,482	3,442,771	4,963,951
May	3,833,097	3,777,990	1,197,873
June	4,676,580	5,338,728	471,195
July	3,599,729	4,721,664	405,240
August	4,951,166	5,886,549	888,220
September	2,972,948	4,722,637	971,929
October	894,786	4,982,118	1,897,950
November	4,994,799	4,894,622	4,984,384
December	5,075,189	4,987,375	4,800,000
Total	45,107,494	53,568,601	33,535,907

There were no important transfers of coal properties during the year, except that a few collieries in the Scranton District were taken over by the Hill-side Coal and Iron Company, controlled by the Erie Railroad. The Delaware & Hudson during the summer entered into a closer traffic arrangement with the Erie, covering tidewater shipments, and turned its business at Buffalo over to the Erie, in line with the policy adopted by both roads some years ago.

An event of some importance growing out of the strike was the resignation of President Walter, of the Lehigh Valley Railroad. He had shown himself an extremely able organizer with a remarkable grasp of the various details involved in mining, transporting and marketing anthracite. During his connection with the Lehigh Valley he had put the road's earnings into improvements of the most substantial character, and was making the road's equipment excellent. His policy, however, did not permit of dividends being paid, and certain stockholders who wished to make money out of the stock by running up its price, found fault with his methods. The anthracite strike, which cut down shipments and income, thus rendering it necessary for the stockholders to consider issuing bonds to raise money for needed improvements, gave the objecting stockholders an opportunity, and President Walter's resignation followed. His successor is E. L. Thomas, chairman of the board of directors of the Erie. It is probable that there will be no marked change in the policy outlined for the Lehigh Valley by President Walter, as heavy earnings due to the abnormal demand for coal will go far to make up losses incurred during the strike. The incident, however, shows that the house of J. P. Morgan & Co., in handling anthracite securities, has to consider both the earning capacity of properties, and the inclination of those parties who wish to make money in a speculative way on Wall Street.

George A. Holden retired as general sales agent of the Delaware, Lackawanna and Western Railroad Company in March. He had held the position since January 1, 1899, when the control of the road changed hands. His retirement marked a final reorganization

of the road under Mr. Truesdale's management, and the end of the long Sloan and Holden regime.

Trade by Months.—The year opened with a very strong market, owing to floods in December, which had greatly reduced the output for that month, and to poor car supply. Buying was brisk at all points. At Chicago supplies on dock were estimated as being fully 170,000 tons less than on January 1, 1901. The regular prices, f. o. b. New York Harbor ports, for free-burning white ash coal were: Broken, \$4; egg, \$4.25; stove and chestnut, \$4.50, with pea, \$3; buckwheat, \$2.50; rice, \$2. Owing to the shortage of bituminous coal, the steam sizes were in good demand, and for prompt delivery hard to get.

By February labor troubles began to threaten producers. Demand in the West continued active, and chestnut size commanded a premium. The demand for steam coal at New York Harbor produced a temporary shortage there of broken size. Cold weather during the early part of February stimulated consumption. Chestnut size was hardest to get. At New York Harbor there was much trouble in making deliveries during the month, owing to ice forming at the docks. At the end of the month storms hindered transportation, while demand along the Atlantic seaboard was excellent.

Dealers by March 1 were beginning to cut orders to actual needs in view of a possible reduction in prices of 50 cents per ton on April 1. On March 5 one of the most disastrous floods in the history of anthracite mining in Pennsylvania caused an almost total suspension of shipments in the Lackawanna, Wyoming and Lehigh regions for several days. At Wilkes-Barre the Susuehanna River rose 32 feet. Along the Lehigh River great damage was done to the rights of way and bridges of the Central Railroad of New Jersey, and the Lehigh Valley. The Lehigh and Schuylkill regions suffered greatly from flooded collieries, some workings not being pumped out for weeks. The total damage to railways and mines probably amounted to not less than \$5,000,000. Not in 40 years had there been such suspension of shipments due to weather causes alone. Naturally a shortage of coal at Eastern points resulted, but warmer weather following the flood checked demand. March ended with a cold wave.

The prospects of a general strike of the miners was now so threatening as to lead to considerable buying in excess of normal wants.

On April 1 the principal companies announced a discount in the East of 50 cents per ton on all sizes, excepting egg and broken. Egg was put on a parity with stove and chestnut, and on broken the discount was but 25 cents. The difference between egg had always been clear profit for the jobber and retailer in the East, who in winter sold egg for the same price as stove. In the West egg had long sold on the same basis as stove. The April prices, f. o. b. New York Harbor shipping port, were: Broken, \$3.75; egg, stove and chestnut, \$4.

The announcement of the spring discounts brought an overwhelming flood of orders, and during the month demand was in excess of supply. Lake navigation opened on April 10, and a fair tonnage started to upper lake points. Along the Atlantic seaboard, and in the all-rail trade demand was very lively during the whole month. Car supply, which showed a slight improvement in March, fell off again and was an obstacle to heavier shipments. Still the April output was very heavy, and considering flood damages in March, remarkable, it being the largest for April on record.

The monthly advance of 10 cents a ton on May 1 had no effect on buying, since a heavy tonnage ordered in April could not be delivered, and buyers with prospects of a strike ahead were anxious to get in large supplies. Most collieries by this time had about recovered from the winter floods. By May 10 trade at the head of Lake Superior was quiet, but demand in all other territories was strong, receipts at Chicago being far ahead of the 1901 figures. Car supply was showing some improvement, the labor outlook, though threatening, seemed to be against a gen-

eral strike, and the prospects favored a very heavy output all summer. The unexpected action of the Hazleton Convention on May 12 changed everything. Anthracite production practically ceased at once, though a few washeries kept at work. When shipments ceased sales agents at New York City declined to take orders for new business, and began to sell what coal they had to regular customers only. This was not so much from fear of a coal famine, since the most experienced men in the trade did not expect the strike to last long, but to stop speculators from gobbling up available supplies. The public, however, got excited. The newspapers raised a howl and prices began to go up. The retailers association in New York City advanced prices \$1 per ton, and in other cities retail prices rose 25 and 50 cents. After the first scare, the public began to substitute soft coal for hard where available, and to economize on anthracite as much as possible. In this way the actual consumption was very much reduced.

The railroads made the usual 10 per cent advance on June 1. This had no effect, since only those favored concerns that had to have coal in order to keep going were able to get it at regular June prices. Dealers at New York, having limited storage capacity, ran short before those at other points, and coal was shipped back to New York from yards beyond Cape Cod, whither it had gone in April or May. By the middle of June bituminous was being substituted for anthracite at New York in hotels, restaurants and office buildings, while prepared sizes were selling as high as \$10 per ton at retail. Cargo lots of pea coal sold up \$5.25 and \$5.50 per ton. At points beyond Cape Cod dealers refused profits of \$3 and \$4 a ton on coal bought in April in order to keep regular customers supplied. The market in the East gradually lost its nervousness, but prices continued high, and by the end of the month the regular retail price at New York was nominally \$7, with speculative coal selling at fancy prices. Over \$6 was paid for pea coal, and \$9 for broken, the latter size being greatly needed by the elevated railroad.

Trade during the summer was light at all points, as dealers restricted sales and retail buying is light at that season, anyway. Gas and oil were used in cities, and oil and wood in the country districts for domestic purposes, while bituminous coal was used for steam production. Wholesale prices at some points showed no advance above the regular figures, as at Buffalo. By the end of the month retail prices advanced at New York City to \$8 a ton, and as high as \$10 in particular cases. Coal at wholesale sold at \$7 and \$8 for prepared sizes, the regular f. o. b. list prices being: Broken, \$4.05; egg, stove and chestnut, \$4.30.

August opened with supplies all over the country getting low, and the public anxious to see mining resumed. In the whole anthracite region but seven collieries and some 20 washeries were busy. At Lake Superior ports most docks were bare of anthracite, while at Mississippi and Missouri River points dealers were trying to get Colorado anthracite and Arkansas semi-anthracite. At Chicago some wholesalers had closed their yards and others were selling but little. Along the lower Lakes and in Canadian Territory, trade was very light, with sales restricted and imports of Welch anthracite were discussed. In the all-rail trade and along the Atlantic seaboard there were wide variations in the amount of coal in stock at different cities and corresponding variations in prices. To show the general situation these retail prices may be mentioned: Kansas City, \$9.50 and \$10; Albany, N. Y., \$6; Springfield, Mass., \$8 and \$8.50; Lowell, \$7.50; Holyoke, \$9; Portland, Me., \$8; Manchester, N. H., \$9; Newark, N. J., and New York City, \$8; Orange, N. J., \$6.50 and \$7; Baltimore, \$7.50; Philadelphia, \$7.75. Speculative coal was offered at wholesale alongside of New York Harbor for these prices: Stove, \$8.45; chestnut, \$8.35; pea, \$7; No. 2 buckwheat, \$4.40; No. 3 buckwheat, \$4.25; rice, \$3.60. Egg and broken were out of the market, as the Manhattan Elevated had taken all the egg and broken size available, not only at New York but at points as far away as Albany and Boston.

Supplies got scarcer and scarcer and prices advanced accordingly. By August 20 retail prices at New York and Boston had risen to \$10, and sales at wholesale at \$11, alongside, New York Harbor, were reported. Prices continued to advance, and by September 10 prepared sizes at Chicago sold for \$11 and \$12 at retail, and at \$10 and \$11 at wholesale. At New York City retailers were selling at \$12 and \$13 a ton, and restricting deliveries to one ton or less. The retail price at Boston was \$10. Docks were bare at the head of the Lakes, and by September 20 the total amount of anthracite in stock at Chicago was not over 12,000 tons. At Baltimore and other points along the seaboard dealers were entirely out of anthracite. Prepared sizes were selling for \$15 at Boston and New York. At New York pea was retailing at \$7.50, buckwheat at \$6, rice at \$5.25, while small lots were reported sold at wholesale for these figures: Broken and egg, \$13.50; stove and nut, \$12.50; pea, \$7; buckwheat, \$5; rice, \$4.50.

By the opening of October public sentiment had reached such a state that it regarded the rights of operators or miners as of less importance than coal supply. The country was experiencing the most acute shortage of anthracite known since that coal came into general use, particularly the region north of Virginia and east of Ohio. At St. Paul, Minn., retail prices had risen to \$12 per ton; at Chicago, \$14; at Springfield, Mass., \$15; at Boston, \$15 and \$18; at Portland, \$15; New York City, \$15 and \$20, with sales as high as \$27 in some cases; at Philadelphia, \$15 and \$20; at Richmond, Va., \$10. Up to this time only about 3,000 tons of anthracite had arrived at the head of Lake Superior since May 16. In Chicago Territory, householders who were obliged to pay \$14 and \$15 for anthracite were preparing to burn soft coal during the winter as were consumers at lower Lake points, and in Canadian territory. By October 10 the strike was virtually over with supplies all over the country nearly exhausted, and prices out of sight. We note these retail figures: Kansas City, \$12; Saginaw, Mich., \$10; Chicago, \$15 and \$16; Boston, \$20; Providence, R. I., \$20; New York City, \$18 and \$25, with pea \$10, buckwheat \$8 and rice \$6.

With the ending of the strike prices fell rapidly at New York, and sales agents were overwhelmed with a rush of orders from all over the country. Everybody wanted winter supplies, and wanted them at once. On October 25 the Philadelphia Coal and Iron Company announced that to cover many expenses due to the strike it would advance its regular winter prices 50 cents per ton to January 1, making its f. o. b. New York Harbor quotations: Broken, \$4.75; egg, stove and chestnut, \$5. Other companies made similar advances.

At the opening of November shipments from the mines were not increasing as fast as the public expected. In the Hazleton region most mines were still idle, owing to the retention of non-union men by operators. Little coal had arrived at the head of the lakes, at Chicago, or at points beyond Cape Cod. Fortunately the weather all through November was unusually mild, and the actual consumption was much under normal, greatly to the advantage of both producers and consumers. By November 20 a fair tonnage was going to upper lake points and to points beyond Cape Cod, these points being in greatest need. Prices, f. o. b. cars Chicago, were: Broken, \$6.25; egg, stove and chestnut, \$6.50. At Philadelphia wholesale prices for prepared sizes were \$5.50 and \$6.50, with retail prices at \$7 and \$9. Retail prices at Boston and Narragansett Bay points had fallen to \$9. At New York, though the nominal retail price was \$6.50, speculative coal sold as high as \$10 for prompt delivery. A lot of steam sizes of very poor quality, which had been rushed to tidewater to take advantage of the market, sold as low as \$2 for buckwheat.

A cold wave early in December, with gales, and lower temperatures than for a corresponding date in 30 years, greatly increased consumption and interfered with coastwise shipments. Retail prices at New York were advanced to \$7.50, with \$9 paid for speculative

coal, and at Boston prices rose to \$12 by December 15. The year ended with anthracite in short supply. At the head of the lakes and in Chicago territory consumers will rely on all-rail shipments during the winter. At points beyond Cape Cod anthracite is in poorer supply than elsewhere, and as high as \$12 wholesale is being paid at Boston. At New York, though the regular retail price is \$7.50, coal produced by independent operators and handled by speculators, sells as high as \$11 at retail. Much of the urgent demand at New York, however, has been due to consumers giving the same order to several dealers.

THE SEABOARD BITUMINOUS TRADE IN 1902.

The bituminous coal trade of the Atlantic seaboard is supplied by four railroads—the Pennsylvania, from the Cumberland field in Maryland, and the Broad Top and Clearfield districts in Pennsylvania, to Philadelphia; the Baltimore & Ohio, from Maryland and West Virginia fields to Baltimore; the Chesapeake & Ohio, from the New River and Kanawha fields of West Virginia to Newport News, and the Norfolk & Western, from the Flat Top and Pocahontas districts in West Virginia, and their extensions in Virginia, to Norfolk. In the years of industrial depression preceding 1899, the competition between these roads was often of a cut-throat character, the Baltimore & Ohio being the chief offender. This competition led to extremely low through freight rates from the railroads to the shipping ports, and thence by water to receiving ports at New York Harbor, and along the New England coast. Thus, the Norfolk & Western carried coal 400 miles for the phenomenally low rate of \$0.0025 per ton-mile. At the same time some West Virginia collieries sold their product as low as 40 cents a ton at the mine.

With the start of the great industrial boom in 1898, with its tendency towards consolidations of industrial concerns, and of railway companies, the principal stockholders of the Pennsylvania Railroad Company seeing the opportunity for developing an export trade in bituminous coal, and seeing the profit to be gained from checking injurious competition among the railroads supplying Atlantic seaboard, began to get control of the railroads by purchases of stock in the open market, thus establishing a community of interest among the bituminous roads, such as was progressing in the anthracite roads through the house of J. P. Morgan & Co. This end was finally accomplished in March, 1899, by the acquisition of a controlling block of stock of the Baltimore & Ohio, and by the purchase of large holdings in the Chesapeake & Ohio, and Norfolk & Western. With the conclusion of these purchases came the announcement of higher freight rates from the mines to the tidewater ports, and the adoption of a territorial policy in distributing various coals; that is, certain railroads were to supply certain territory, the object being to do away with long rail hauls, and to keep cars in service on the lines to which they belonged. Thus, for instance, Norfolk & Western coal was practically shut out from New York Harbor ports. The railroads, or rather the Pennsylvania management, continued this territorial policy through 1901 and 1902.

Producers at first were inclined to look upon Pennsylvania control with equanimity, believing that a settled policy, with the establishment of definite rates each spring from which there would be no deviation throughout the year, though it might result in higher prices to consumers, would benefit both producers and dealers, and check wide fluctuations in price. During 1901, however, and particularly during 1902, there was growing discontent among producers. At the same time the Pennsylvania management can offer plausible excuses. Heavy crops and the enormous growth of our industrial activity have

pushed to the utmost the carrying capacity of railroads all over the country, and the demands on the Pennsylvania system have been beyond all precedent. In the fall of 1901, and again during 1902, the road was bothered by a shortage of cars and particularly by a shortage of locomotives; hence the management could always tell producers who complained of short car supply that the railroad was doing the best that it could, and that the shortage at the mines was due to causes beyond its control.

Making every allowance for the causes named, however, it is nevertheless true, that bituminous producers have grounds for complaint. It has been alleged that one of the largest coal companies shipping over the Pennsylvania Railroad has had no such trouble with car supply as other companies which were not on intimate terms with the Pennsylvania management. It is also alleged that the Norfolk & Western, and Chesapeake & Ohio have discouraged the development of coal lands along their lines, and have cut down car supply to some producers from ulterior motives so that concerns owning coal properties along these railroads have been obliged to sell out to other companies in which persons connected with the management of the roads in question have been stockholders. These statements are given for what they are worth, but they reflect pretty accurately the present feeling of a great many producers shipping to the Atlantic seaboard.

It is also alleged that had the railroads named tried their utmost to get coal to the seaboard from the Maryland and Pennsylvania districts, and those mines in West Virginia that were little affected by the strike, the public would have been saved expense, inconvenience and even distress. The market at New York and other shipping ports was for months determined by the car supply and by the promptness shown by the railroads in moving loaded cars. It is stated that the Pennsylvania could have given better service had it temporarily discontinued a few limited express trains run for advertising purposes, confined its attention to traffic which it would ordinarily take, and not gone out of its way to compete with the New York Central in hauling grain from the West. There were times during 1902 when it almost seemed as though the Pennsylvania Company was not trying to give the best service possible, when a break in the high price of soft coal was followed by poorer car supply or irregular and slow transportation. Taking these facts into consideration, one is almost justified in saying that had the railroads done their utmost to get bituminous coal forward, anthracite need never have sold at the high prices that prevailed during the strike.

Consolidations and New Companies.—There were numerous changes of coal lands in the West Virginia fields and in Pennsylvania during the year, probably as many as in 1901, though new companies had to meet discouraging conditions. The most important event of the year was the purchase in July of coal lands and railroad lines by the Goulds, the purchase being intended to give a direct Atlantic connection for the Wabash system and make that system a factor in the seaboard soft coal trade. The lands purchased were the holdings of the Davis Coal & Coke Company. The roads were the West Virginia Central Railroad from the coal fields to Cumberland, controlled by the Davis Company, and the Western Maryland road, owned largely by the City of Baltimore and running from Baltimore to Hagerstown, with a branch to Gettysburg, Pa. This did not give a through system, and some miles of railroad are now under construction. The West Virginia Central had shipped mainly over the Baltimore & Ohio. Owing to a conflict of interest between the Goulds and the Pennsylvania over the telegraph and lines along the Pennsylvania, considerable trouble de-

veloped, and as a result the mines shipping over the West Virginia Central had great difficulty in getting cars from the Pennsylvania. As the Davis Coal & Coke Co. had previously taken a large contract at below the current price, to supply the New York, New Haven & Hartford Railroad, it found itself unable to ship according to contract, and had to purchase coal in the open market much to its disadvantage. The new coal road by way of the West Virginia Central and Western Maryland, is a round about line, one at least of the roads is in none too good condition, and probably a considerable outlay of time and money will be necessary to make the line an important factor in the trade, but the fact that the line will be controlled by interests unfriendly to the Pennsylvania is of much importance, and is likely to have some influence on freight rates from the mines, and on the tidewater prices of coal within the next few years.

In Pennsylvania the most important new company was Somerset Coal Company, controlling a large acreage in Somerset County. It will be an important factor in the New York market.

Trade by Months.—At the close of 1901 the market was excited and bunker coal was selling as high as \$4 per ton, f. o. b. New York Harbor shipping port, for immediate delivery, as floods along the roads had temporarily interrupted shipments. By the middle of January, 1902, trade conditions had improved, and a lot of coal had reached tidewater, though many producers were still unable to furnish coal up to their contracts. Speculative prices had fallen to about normal figures, that is, to about \$2.65 and \$2.85 for Clearfield grades, f. o. b. New York Harbor shipping port. Georges' Creek was out of the market. Toward the end of the month car supply fell off again, producers getting less than 50 per cent of the total number wanted. Consumers in the all-rail trade were burning pea, or any anthracite steam size they could get.

February opened with car supply poor, and consumers at Long Island Sound points, at New York Harbor, and in the all-rail trade found difficulty in getting coal. The better grades of bituminous were practically out of the market at New York so far as transient buyers were concerned, and remained so for the year. Some contracts for the new year were taken by producers, generally on a provisional basis, the railroads not having announced what freight rates would be. The possibility of strikes in some fields, though not regarded seriously, had its effect in closing contracts. By the middle of the month, the poorer grades of coal were in fairly good supply, except in the all-rail trade, and car supply showed little improvement. Ice blockades interfered with shipments for some time, both Philadelphia and Baltimore being practically closed. A general meeting of the Bituminous Association was held in Philadelphia on February 22. This association is not formed to control prices, or regulate trade by hard and fast agreements, but rather it aims to bring in contact the principal producers and dealers, and give opportunity for discussing trade situations without newspaper interference. It favored continuing old prices for new contracts.

Heavy floods early in March interrupted traffic, and prices of coal advanced, \$3, being the current price for Clearfield, f. o. b. New York Harbor shipping port. Contracts were taken for the coming year at slight advances over the previous year's prices, but the producers did not seek contracts, and some producers of high-grade coals cut their tonnage allotments to be sold under contract considerably, fearing short car supply or other hindrances. By March 15 prices had risen to \$3.25 and \$3.50 for spot coal, f. o. b. New York Harbor shipping ports. Transportation improved, though car supply was no better, being but 25 to 50 per cent of the demand. Con-

sumers at Long Island Sound points and in the all-rail trade, were still much in need of coal.

By April 1 car supply had improved to about 50 per cent of the demand, while vessels for coastwise business were coming out of winter quarters. By the middle of the month, car supply of the mines had increased, and transportation from the mines to tidewater was fairly prompt. The pressing needs of consumers were supplied, and only in all-rail territory was there a marked shortage. Clearfield grades of the poorer sort sold as low as \$2.55, f. o. b. New York Harbor shipping ports. At the end of the month transportation became slow and irregular, though our supply remained at about 75 per cent. Prices were firm, with all-rail points in greatest need. By the opening of May, most producers had taken about all the contract business they wanted, many having cut down their tonnage to 25 per cent from the preceding year. Demand continued strong. Car supply showed wide variations from week to week.

When the strike in the anthracite fields was declared, and anthracite shipments stopped, vessel supply for bituminous business naturally improved. Demand continued heavy at Long Island Sound points, and in the all-rail trade. Car supply had been about 75 per cent of the demand, and transportation prompt, but when the anthracite roads on May 12 started to lay off engines and train crews and to side track empties, car supply to many bituminous producers was immediately cut 50 per cent or more from the previous week's figures. By May 20 the soft coal trade was much excited, from fears that the strike might spread to bituminous mines. All consumers wanted to get a little coal ahead, and spot Clearfield sold up to \$3.50 per ton, f. o. b. New York Harbor shipping port. By the end of the month car supply improved, and was as good as it was during the whole year, being 75 to 90 per cent of the demand. The Pocahontas and New River miners were preparing to go out and the demand for coal was very heavy, prices at New York Harbor being from \$3.65 to \$4 per ton.

After June 1 the market became largely speculative, prices varying as car supply and transportation affected arrivals at tidewater. A larger proportion of the miners in Virginia and West Virginia quit work on June 7 than was anticipated, and though few mines were completely closed the output was cut down immediately about 80 per cent. Speculative prices rose to \$4.50 and \$4.60, f. o. b. New York Harbor shipping port, and consumers along Long Island Sound, and in the all-rail trade were in need of coal. Producers shipping under contracts distributed their allotments carefully, so that no one contractor was allowed an excess. In this way enough contract coal came forward, but buyers not protected by contracts had to buy speculative coal. Speculative prices at New York Harbor shipping ports soon rose to \$4.85 alongside, for the better grades of Clearfield, though car supply at the mines was about 90 per cent of the demand, and transportation was fairly prompt.

At the opening of July men were returning to work at the mine in the Pocahontas region. The speculative market was active, with supplies still short in the all-rail trade. By the middle of the month vessels for coastwise traffic were plentiful, and transportation from the mines to tidewater quick, though irregular, with car supply fairly adequate. Speculative prices dropped to \$3.25, f. o. b. New York Harbor shipping port for Clearfield. Fully 95 per cent of all contractors now had their full quotas to date delivered. Complaints were heard of an apparent connection between speculative prices and variations in car supply, and speed of transportation, good or bad car supply at the mines and quick or slow transportation to tidewater being followed by falls or rises in speculative prices. The decision of the Indianapolis Convention on July 17 against

a general strike of bituminous miners greatly reduced the demand, particularly in all-rail trade.

By the opening of August speculative prices had risen to \$3.05 and \$3.25, f. o. b. New York Harbor shipping port for Clearfield grades, and some coal from the Pittsburg District was arriving at seaboard points attracted by these prices. Car supply was 80 per cent of demand. By the middle of the month the market was comparatively easy, with speculative prices for Clearfield, about \$3, f. o. b. New York Harbor shipping port. Some large blocks of Nova Scotia coal were contracted for delivery at points beyond Cape Cod at prices under \$3 per ton delivered. There was some shortage in supplies along Long Island Sound, but all-rail trade was in an easier position than in several months. Miners continued to drift back to work, and by the end of the month the strike in the Pocahontas District was practically over. Car supply became poorer, ranging from 50 to 90 per cent, and transportation slower, with the result that the prices for Clearfield advanced to \$3.50 and \$3.55 per ton, f. o. b. New York Harbor shipping port. Deliveries on contracts to shoal water ports beyond Cape Cod were rushed in order that the end of the anthracite strike might not find contractors unable to secure vessels.

By the beginning of September there were few mines shipping from the New River region idle. Car supply and transportation gradually improved and speculative prices fell to \$3.75, f. o. b. New York Harbor shipping port. Toward the end of the month a serious car shortage began to develop. Coal was in short supply at Long Island Sound ports, and in the all-rail trade. At the end of August the market became suddenly nervous and panicky, and speculative prices jumped up so fast that the oldest men in the trade were puzzled. The blame was put on the Pennsylvania Railroad; with an extraordinary demand for coal along the seaboard due to the anthracite strike, car supply had fallen off, transportation was slow and irregular, and less than a normal tonnage of bituminous was arriving at the shipping ports. It was alleged that the Railroad was not really trying its best to relieve the situation, but was simply educating producers and consumers to a contemplated advance in through freight rates, the coming April, to 25 cents per ton or more. The demand was heavy, because bituminous had supplanted anthracite in hotels, factories and public buildings, and even to a considerable extent for domestic purposes, and finally because the New York, New Haven & Hartford Railroad made large purchases in the open market, owing to inability to get coal on its contract with the Davis Coal and Coke Company. The situation was worse at the points beyond Cape Cod, where on September 25 Clearfield grade sold, f. o. b., for \$7.50 and \$8.50, while at New York the price was \$6.35 and \$6.50.

October opened with the market still nervous and excited, though producers brought every influence to bear on the Pennsylvania Road, and put the onus of the situation squarely on President Cassatt. In some cases as high as \$9 per ton was paid for Clearfield at New York Harbor ports. The situation in the East was relieved a little by importations of Canadian coal, and some purchases of English coal. The tonnage of Canadian coal and English coal reported bought was about 200,000 tons, a small amount, but enough to check advances in the market. A lot of coal from Western Pennsylvania fields attracted by the high prices was arriving at seaboard points. Many manufacturing concerns, including two large smelters at New York Harbor points, had closed down rather than pay \$8 or \$9 per ton, and other industrial plants gave notice that \$4.50, New York Harbor, was about as much as they would pay. Car supply was very poor, not averaging better than 40 per cent of the demand, and at the railroads bothered producers by

seizing coal in transit or standing at tidewater, taking 10 or 15 cars at a time. By October 15 the market had quieted wonderfully, the anthracite strike was virtually over, and speculative prices of Clearfield grades fell within a few days from \$8 to below \$6 per ton, f. o. b. New York Harbor ports. English and Scotch coal was arriving at New York Harbor and at ports beyond Cape Cod, some north of England coal being offered at below \$7 per ton, f. o. b. New York Harbor.

By October 25 speculative prices which had fallen as low as \$4, had risen to \$5, f. o. b. New York Harbor shipping port, for Clearfield grades. Transportation from the mines was slow and irregular, while car supply was about 50 per cent. Long Island Sound points and the all-rail trade were in greatest need of coal. Heavy arrivals of foreign coal early in November at points beyond Cape Cod and at New York Harbor eased the market. Towards the end of the month car supply fell off to 40 per cent of the demand, and Clearfield grades advanced in a speculative way to \$5.35 and \$5.50, f. o. b. New York Harbor, and by November 30 prices were up to \$6.25. Arrivals of English coal were about over, and speculators who had bought considerable coal at high mine prices were holding it to get out without loss. Demand was strong at all points and shipments to the ice ports down East were very heavy.

By December 5 car supply improved and speculative prices dropped to \$5.50, f. o. b. New York Harbor shipping port for Clearfield grades. Within a short time, however, car supply fell to 35 and 40 per cent of the demand. Then a cold wave and storms increased demand and interrupted coastwise shipments. Speculative prices again jumped, and by December 15 coal was selling as high as \$7.25 per ton, New York Harbor, and \$10 at points beyond Cape Cod. Car supply continued poor to the end of the year, and speculative prices remained high, bituminous at Philadelphia selling for \$7 or more than the prepared sizes of anthracite. Storms wrecked vessels and interrupted coastwise shipments so that prices at Boston rose to \$10 per ton. Boston concerns ordered more coal from abroad, but profited by their experience with the previous importations, some of which had proved of inferior quality, and often was largely dust when unloaded. The recent purchases are expected to give better satisfaction. The year closed with coal in short supply in the all-rail trade, and at points beyond Cape Cod.

There seems little chance of any immediate improvement in car supply, and coal prices will probably be high all winter.

Coastwise Freight Rates.—While coastwise freight rates during 1901 remained unchanged for many months, the market during 1902, owing to causes outlined in the general review above, fluctuated widely. The year opened with vessels in poor supply, current rates from Philadelphia being \$1 to Providence, New Bedford and the farther Long Island Sound ports, and \$1.15 to Boston, Salem and Portland.

With the coming of milder weather rates fell by March 20 to 80 cents to Providence, New Bedford and Long Island Sound, and 95 cents to Boston, Salem and Portland. By April 5 rates from Philadelphia to Providence and New Bedford had fallen to 75 cents, and to Boston, Salem and Portland to 85 cents, while rates to Portsmouth were 90 cents.

By June 15 rates had fallen, owing to the stopping of shipments from West Virginia, and were 70 and 75 cents to Providence and New Bedford, and 85 and 90 cents to Boston and Portland, 90 cents to Portsmouth, and 95 cents to Bath and Bangor, while rates from Chesapeake Bay ports were 10 cents higher. By August 1 so many vessels were waiting for charters, and so little coal waiting shipment, that many craft returned East light,

to load with ice, or lumber. Rates were 50 and 55 cents to Providence and New Bedford, 60 cents to Boston, 65 and 70 cents to Portsmouth, 70 cents to Portland, 70 and 75 cents to Bath and Bangor. In September rates showed but little change during the month, advancing about 5 cents a ton at the close.

By October 1 demand for coal was so heavy that vessels were put in at the roading port under charter to wait six weeks or even longer, freight rates in such cases being according to individual contract. By the end of the month small craft were very scarce, and rates advanced. The settlement of the anthracite strike and the needs of anthracite shippers started a steady advance, and by November 15 were 65 and 75 cents to Providence and Long Island Sound, \$1 and \$1.10 to Boston and Portland, \$1.15 to Portsmouth, \$1.25 to Bangor, and by the end of the month were 90 and 95 cents to Providence and Long Island Sound, \$1.10 and \$1.15 to Boston and Portland, \$1.25 and \$1.50 to Bath and Bangor, with rates from the Chesapeake Bay ports 15 cents higher. Stormy weather early in December, which wrecked and disabled many vessels, and held a large fleet in port for many days, caused a tremendous jump in freight rates. By December 25 rates were up to \$1.25 to Providence and Long Island Sound, \$1.75 to Boston and Portland, while from New York Harbor ports vessel rates to Boston were \$2 and \$2.25, and to New Haven barge rates were \$1.35. By December 25 rates were higher than in 25 years, except for a few charters made in 1898, being \$1.50 from Philadelphia to Providence and Long Island Sound, \$2.25 and \$2.50 to points around Cape Cod, while from New York Harbor rates to Providence were \$1.50 and \$1.60, and \$3 to points beyond Cape Cod; barge rates from New York to New Haven advanced to \$1.40 and \$1.45, discharged. The year closed with rates a trifle easier.

THE BIRMINGHAM COAL MARKET IN 1902.

By OUR SPECIAL CORRESPONDENT.

The year closed with a short production for the last week, as is usual in the holiday season. The miners, however, have returned to work with unusual promptness, and everything is going smoothly. Returns are being received by the State coal inspector from the different mines, and there is no doubt that there was a large increase in the production. Work was steady throughout the year, with an exception of about three weeks in July, when it was stopped, pending the settlement of the mining rate for next year. There were one or two small miners' strikes, which did not last very long. The most serious interruption to production was due to the shortage of railroad cars during the closing quarter of the year. This shortage, however, was by no means as bad as that which prevailed in the West and Northwest.

The production of coal in Alabama, which was 8,273,362 tons in 1900, increased to 8,970,617 tons in 1901, while in 1902 there is no doubt that the complete figures will show an increase of over 1,000,000 tons, bringing the total up to a little over 10,000,000 tons. With the opening of new mines and the increase of work at others, good authorities estimate that the probable production in 1903 will be 12,000,000 tons.

The production of coke during the year was also large. In 1901 there were 7,086 coke ovens in operation and the production was 2,180,625 tons. In 1902 the estimated production of coke was 2,400,000 tons. A considerable number of coke ovens were built during the year, and others are now under construction. By the middle of 1903 there will be at least 9,000 coke ovens in operation, and the output for the year should reach 3,000,000 tons.

The coal and coke output in Alabama is large-

ly dependent upon conditions of the iron trade, and as long as this continuous prosperous, there is no reason to anticipate any falling off in the mining of coal. As has been recorded in our columns throughout the year, a number of new mines have been opened under the stimulus of the good demand and high prices, and there is still room for considerable development. The home demand has been so large and so steady that comparatively little attention has been paid to deliveries outside. Nevertheless, considerable shipments have been made to Pensacola for export and for the supply of steamers at that port, and a large quantity has also been shipped to New Orleans and other points on the lower Mississippi by way of Greenville.

The coal miners have received practically only one price during the year, and that is the maximum under the old scale of 55 cents per ton, with the usual differentials on account of local conditions. There seems to be little doubt that this maximum rate will be continued to be paid for some time to come. The year opens with no labor difficulties existing in the State, and the miners are apparently contented.

An important change has been made in the handling of the convicts, of whom a considerable number have been leased from the State by the Tennessee Coal and Iron Company and the Sheffield Iron and Steel Company. Heretofore these convicts have been hired from the State at a fixed rate, the companies undertaking their guarding and maintenance. Beginning with the new year, the companies will pay the State the regular mine rate for all coal mined by its convicts, while the maintenance, housing and guarding of the men will be performed by State officers, and at the expense of the State. This arrangement is, upon the whole, satisfactory to the companies, while it is anticipated it will bring a large return to the State for its convict labor.

THE CLEVELAND COAL MARKET IN 1902

By OUR SPECIAL CORRESPONDENT.

To have followed completely the coal trade of this section for the past year in all of its ramifications would have been necessary to have carried a story of the distresses of all the industries in this section. In the lake end of the coal trade the situation assumed interest and importance at once. It was apparent when the season opened that the stock piles at the head of the lakes had been exhausted, or so nearly so that an early opening of the season of navigation was earnestly hoped for. This came more rapidly than expected, and by the latter part of March the first cargoes of coal were being shipped up the lakes. The hard coal movement began almost as soon as shipments started through the bituminous coal shipping ports. This enabled the hard coal shippers to get about 300,000 tons of hard coal to the head of the lakes before the strike was called early in May. At the time this strike began there was a large amount of hard coal on the trestles at Buffalo and Erie, which was immediately withdrawn from the lake trade and reserved for whatever emergencies might arise after that. The coal shortage quickly became so severe that much of the material which had been designed for the lake trade was withdrawn or stopped in transit and shipped East to the relief of the consumers there. The apprehension for the supply of coal increased when July 8 the miners in the Pocahontas District went out on a strike in sympathy for the miners in the anthracite region.

It was about that time that the rumor of a general strike of all of the miners of the country ripened into the call for a meeting to discuss such a possibility with the result that the various business interests were well-nigh paralyzed with apprehension of what the future might bring. It was realized at the time that a movement of such magnitude would do great harm, which would

fall alike upon the miner and the operator. It was hardly believed that such a step would be taken. Notwithstanding this skepticism the various interests began immediately to make arrangements for the time when coal should be withdrawn. The railroads in this territory at once began to confiscate the coal on their tracks, and they carried this out until all possibility of such a strike was entirely removed. There are still strong evidences of this fear all along the various lines of railroad in this territory, where coal is piled up to meet the possible contingencies. This movement practically stopped the shipment of coal by the lakes, and incidentally interfered greatly with the possible supply for this city. It was said at the conclusion of this movement to confiscate the coal supply, that the various industries of Cleveland did not have a 24 hours' supply ahead of them. The fear of a general strike having been removed the railroads permitted the free movement of the coal from the mines without, however, unloading any of the material which they had confiscated. This did not leave the shippers by lake in any condition to make the movement for which they had contracted earlier in the year. The season of 1901 had shown shipments by lake of 9,000,000 tons of coal. Of this amount something over 4,000,000 tons had been anthracite and moved through Erie and Buffalo. The prospects for the season of 1902 were that the lake movement alone would amount to about 11,000,000 tons, as the early sales had been quite heavy. The situation in which the consumers at the head of the lakes found themselves can be more easily imagined than explained when it is said that the after shipment of the 300,000 tons before the first of June the hard coal movement was suspended and the sole dependence was placed in the supply of soft coal, which was also shipped in smaller quantities because of the scarcity of cars with which to move the material from the mines to the lakes. The story from the early part of June until the latter part of October is one prolonged wail of distress. The expectations were that the movement would be each week heavier than the same week for the preceding year. The way it turned out was that there was hardly a week when more than 70 per cent of the needed coal was moved, and often it fell as low as 40 per cent of what was required. This threw the general shipments even below what had been done the previous year. The thing was not easily explained, and there was throughout the year a contention always raging between the coal operators and the railroads as to who was to blame for the general distress. The railroads averred that the coal supply was short, while the operators said that the railroads lacked the equipment and the motive power with which to move the material. It might be said with perfect safety that the two explanations taken in conjunction about sized up the situation for all of that distressing summer when the popular fear and anxiety gave zest to the sales that were made, and it was evident that the public was greatly wrought up over the situation. The anxiety was increased through this circumstance. Most conservative and well-to-do people have been in the habit of laying in their supply of coal during the summer when the prices are down. It was evident this year that this could not be done.

The supply on the market was just about enough to meet the current needs, and the dealers made sure that the purchasers did not want the coal for storage purposes. There was a double reason for this, the first being that the dealers did not want the consumers to corner the coal supply and cause a shortage for actual needs at present, and that they also expected that prices would naturally rise in the fall, and this business could be done at higher figures. These two considerations kept the public on the anxious seat during the entire summer, and also seemed to keep coal scarce.

Under the circumstances it is hardly to be ex-

pected that the supply of coal should be anything like normal. The shipment of 70 per cent of the supply required was but putting the coal consumers in the Northwest on the same restricted basis as the consumers in the immediate vicinity of the mines. The situation in the Northwest, however, was much more aggravated than the soft coal movement seemed to indicate, as that section was deprived of hard coal.

This situation is of importance in describing the conditions which obtained later in the fall. The movement of hard coal began immediately with the declaration of the end of the strike at the close of October. The anthracite which had been held on some of the trestles at Buffalo was immediately released for shipment, and the lake trade assumed interest and importance which it had not had earlier in the year. Buffalo and Erie immediately began to bid for tonnage, and the coal rates took on a different aspect from what they had had since the early spring.

At the beginning of the year the shippers of coal offered 40 cents to Lake Michigan and 30 cents to Lake Superior, believing that the ore rates which had been previously established warranted no higher freights. The vessel men contended for a higher rate by 10 cents a ton to each port, and there was, after a long controversy a settlement by a mutual concession, the rates going to 35 cents to Lake Superior and 45 cents to Lake Michigan. The Lake Michigan rate for the time being was on going cargoes, there being no contracts at that figure. In fact, it is not known that any contracts were made during the year on such a basis. A little later when there was a controversy over ore rates a trade was made by which the ore rates might be advanced if the same shipper got a rate of 40 cents to Lake Michigan on the coal. This change was made, and a good block of Lake Michigan coal went in at the 40-cent rate. The only other change in the freights during the summer was a drop in the going rate to Lake Michigan early in June. The hard coal strike had not been on very long when the boats began crying for coal cargoes, which they were not able to obtain. The absence of grain out of Chicago and the consequent easy demand for boats on Lake Michigan sent more of the vessels to Lake Superior. This with the lessened number of coal cargoes operated to make the demand for vessel tonnage very light indeed out of Lake Erie ports, and after a brief season of enjoyment of the 35-cent rate the vessel owners were compelled to come down to the basis of 30 cents, which obtained until the approach of the end of the season, when a temporary spurt was made.

When the strike of the hard coal men had ended the shippers of coal were in a position to become immediately the prey of vessel interests, and the latter class being well grounded as to their own interests immediately took advantage of the situation. It was generally known that the shippers were far short of their season's shipments. It was a logical surmise, under the circumstances, that the shippers would not stop to dally about rates. The vessel interests were not wrong in this supposition, and it was a vessel owners' market for the remainder of the year. The only thing that put a block to the advance of rates was the possibility of all-rail competition. Under this situation the rates gradually advanced until \$1 was paid to the head of the lakes. The last boats passing up did not get through the Sault Canal until well along toward the middle of December, and then forced the passage only with the assistance of three tugs, all of them charging the ice pack at the same time. It is an interesting feature that the Pittsburg Steamship Company, which had been a bear in the ore market all summer, became a bull in the coal market toward the end of the fall, and was successful in obtaining the highest possible rates. In a few instances \$1.50 was paid on coal cargoes to ports on Lake Michigan.

The feature of the domestic coal trade prices during the fall was the action of the retail dealers in this city. When the hard coal supply fell short there was a good demand for soft coal. Prices advanced until they were 100 per cent higher than during the summer and fully 75 per cent higher than this time a year ago. Massillon coal is now bringing \$5.50 on the open market here, with anthracite up to \$7. These prices were forced, in a measure, by the action of the soft coal operators, who, during the stress, forsook those having contracts to sell their material to those who offered premiums. This was so generally done that many of the retail dealers were forced to buy at the higher prices, and naturally took the increased cost out of the public purse. The attitude of the railroads toward these increased prices has been interesting. There was a strong element among the Ohio coal carriers which wanted to advance the rates, but it was prevented from doing so by the more conservative element. The same committee, however, was forced to admit that the cost of fuel to the railroads had been increased, and they tried to even up affairs by charging higher fuel rates to the lines in Michigan, which get coal from this territory. There has been a general agitation for increased coal rates, but the movement has been withstood on the part of the conservative lines. In the fuel coal line there is an interesting situation developing toward the end of the year, which is an immediate outgrowth of the strike. The coal companies have given notice to the lake vessel owners that they are considering an increase in the coal prices for the ensuing year, and suggest that it will be 20 cents a ton.

The new year opens, therefore, with the local supply of coal fairly good, and with conditions favorable to a continuance of that state of affairs. It promises, however, that there will be an early spring movement for the relief of the consumers in the Northwest that will at once jeopardize the domestic supply and give the railroads a problem which may be difficult to solve.

INDIANA COAL PRODUCTION IN 1902.

By Our Special Correspondent.

Coal mining developments during 1902 are without a parallel in the history of the State. The investment of capital in opening up new mines and operating old mines surpassed all previous figures. Coal land investments continued steady during the entire year, and large transactions are still of frequent occurrence. The average price for coal land is \$80 per acre for coal privileges only, the seller retaining the surface for farming and grazing purposes. The failure of natural gas caused manufacturers in the gas belt to purchase large tracts of coal land.

There are 15 coal-producing counties in the State, and the total number of enrolled mines is 179, exclusive of a large number of small mines, to which the mining laws do not apply. Only one mine was abandoned during the year and 18 new mines were opened since the last report made to the governor. Complete figures are not yet obtainable, but a conservative estimate places the total output of coal during 1902 as 8,357,417 tons, or over 1,000,000 tons more than in 1901. Surprising as this increase may seem, the tonnage would have been much greater had the railroad companies furnished sufficient transportation, as a number of mines were idle part of the time. The records in the Mine Inspector's Department show that a larger number of men were employed in mining during the year than ever before, but the increase in the individual output of mines is also largely due to the use of improved machinery and appliances, electric haulage and hoisting apparatus, etc. The indications are that there will be a large increase in the number of mines during 1903. Coal-land is being

bought for development, steam and electric railways are being built so as to tap the coal territory from several directions.

All conditions considered, operators and mine workers in this State are enjoying greater profits and prosperity than ever before. The year was free from labor troubles, and the agreement made at the convention of miners and operators has been kept. Figures showing the wages paid to miners will not be available until the middle of January, but a fair estimate by persons in a position to know give the aggregate between \$5,250,000 and \$5,500,000.

The consolidation of the Indiana coal mines under one corporation is by no means unlikely. Options have been extended until May 1, and the deal may go through by that time. The options represent an expenditure of \$10,000,000. The stock will amount to \$25,000,000. According to the reported arrangements, \$11,000,000 will cover the properties under option, and the working capital. The options are principally on the 40,000 acres of coal land, and the 34 mines in Sullivan and Green counties.

COAL IN KANSAS.

By Erasmuth Hayworth

The year 1902 was the most prosperous for coal mining in Kansas, if measured by the total output and aggregate value of product. The production is the largest ever known, aggregating 5,379,500 tons, which had an average market value at the mine of \$1.43, yielding \$6,727,065.

Crawford County still continues to lead the other counties, with Cherokee County a close second. These two counties combined produce more than four-fifths of the total output of the State. Leavenworth and Osage counties come next, producing about equal amounts, then follow 14 or 15 other counties, which yield some coal, principally consumed by the wagon trade, but here and there are mines near railroads, shipping small tonnages. Linn County had such a mine beside the Missouri Pacific tracks, 2½ miles east of Pleasanton; Franklin County had two such mines, one located on the Santa Fe track at Ransomville, and another one at Pamaona.

Almost all the coal of the State comes from the Lower Coal Measures, the single exception being the soft Cretaceous coal mined in small quantities in the west central part of the State in Republic, Jewell, Cloud, Mitchell, Lincoln and Ellsworth counties. Within the Coal Measures the Cherokee shales are the most productive, supplying all the coal from Cherokee, Crawford, Bourbon, Labette and Leavenworth counties. Next above the Cherokee shales we have Pleasanton shales, which produce the coal of Linn County; still higher up are the Lawrence shales, which produce the Franklin County coal, and above these the Osage City shales, producing the coal of Osage County at Osage City, Scranton, Carbondale, Burlingame and a large number of other points where but little coal is mined, but which form a line of mines extending entirely across the State from north to south. The Osage City shales are about 2,000 feet above the base of the Cherokee shales, making their coal about 1,800 feet above the Cherokee-Crawford County coal beds.

The coal of Cretaceous age in Kansas is poor in quality and quite limited in quantity. Almost no prospecting has been done for it, excepting along the line of outcropping. Last winter a drill hole was put down for other purposes near Jewell City, in the southeast corner of Jewell County. It started in the overlying Benton formations, but reached the Dakota coal-bearing shales at a depth of 175 feet. Here a seam of coal was cut nearly three feet in thickness, in quality about the same as other Cretaceous coal in the State. Mining operations have already resulted

in the production of a few thousand tons sold to the local wagon trade. Quite likely similar prospecting elsewhere might develop Cretaceous coal which would prove better than that found along the outcrop.

THE YEAR'S WORK IN THE SOUTHWEST.

By DR. THEO. B. COMSTOCK.

Southern California and Western Arizona, with the southeastern quarter of Nevada, are the peculiarly appropriate gleaning grounds of Los Angeles as a commercial center, although the distribution of working capital and mining supplies is not by any means restricted to this area. The progress of mining in 1902 is difficult to measure, because it is largely prospective. This condition is due to two causes. The bubbles which formed the froth of the oil excitement of two years ago were dissipated completely before the opening of 1902, without reducing promoters' office expenses in proportion to the diminution of available funds, and the assurance of railroad construction through a region previously all but inaccessible afforded abundant opportunity for the launching of new mining enterprises in unproved fields. There is nothing new in the story, except the locality. Rich strikes stimulated the gambling

First, exploration has gone on apace, and we have a much better knowledge of our resources than heretofore. Much credit is due Mr. L. G. Aubury, California State Mineralogist, and his efficient corps of assistants for this result, although the foolish demands for hasty returns have largely precluded acquiring that fundamental knowledge of the geology which is essential to the most permanent benefit. They are decidedly wrong who discredit the very valuable work performed by earlier workers in preparing the way for what is now becoming possible in more popular form.

Second, there has been very material reduction in mining costs in various ways. These beneficial results have occurred partly from the increased facilities of transportation and, to a notable degree, from the investment of ample capital under thoroughly skilled engineering advice.

Third, progress has been made in the dissemination of such knowledge among investors, as will enable them to judge more wisely of the business features of projected enterprises.

There have been sensational reports of discoveries in Southern California, and some new districts have attracted attention.

The Gold Regions.—The Randsburg District

of San Bernardino County, California, where some very promising developments have been made in 1902; thence across the Colorado River, into and through a portion of Arizona, by way of the north end of Yuma County, and on both sides of the boundary between Yavapai and Maricopa counties. The Congress Mine and others well known, are in this zone. The ultimate output of a very extensive line of outcrops in this trend, appears to be only a question of the judicious application of capital. There has been some exploration in the neighborhood of Victor and south of Daggett, in San Bernardino County, California, but no adequate development. In Arizona, in the Bradshaw Mountains, in Yavapai County, very high-grade ore has been found in the deeper workings of well-known mines, and the continued development of the region around Prescott is more than justifying the faith of its advocates. Farther southward, as yet but little explored in California, are the belts which include the King of Arizona and La Fortuna mines, in Yuma County, Arizona, extending eastward across Arizona. The Mammoth, of Pinal County, temporarily idle on account of litigation, lies in the course of the more northern belt and the rich deposits of Cochise County, such as the



TILLEY CREEK, SHOWING SLATE RANGE IN BACK GROUND—YORK REGION, ALASKA.

propensity of the masses enough to supply something like twelve or more months of office expenses, a liberal allowance of commissions to brokers, fair profits to prospectors and working capital for the immediate needs of some of the more promising ventures. At such times, it always happens that a few enterprises are carried beyond the point of meeting the heavy costs of stock manipulation and the comparatively light investment at the mines. The industry itself is now beginning to feel the inevitable reaction, which is liable to drag down some meritorious enterprises along with the riff-raff which are alone responsible for the immediate popular verdict. Nothing is to be gained by dwelling upon this theme. Strictly speaking, those who have suffered are rarely deserving of sympathy, because the simplest business precautions would have avoided calamity to any but the promoters.

This is not unique in its application to our district, but the disease has been general throughout the country. The conditions which have favored it have been prevalent here because of the large territory which has heretofore remained unexplored in the desert areas of California, Arizona and Nevada.

So much for what has been. With all the evils of these boom periods, which appear inevitable at one time or another in every camp, there are concomitant symptoms of much more encouraging character.

has held its own and gained reputation by steady exploitation, with some promising additions not prominently in evidence before the public. Structurally, on the plan outlined by the writer in treating of the geology of Arizona,* this tract is identical in its main features with the true gold belts to the eastward. More or less desultory mining at other points in California and Arizona, on the same individual belt, have justified the general conclusion that many more important discoveries will be made over the area, and the recent developments at Searchlight, in the New York markets and elsewhere, afford additional support. This belt extends from eastern Kern County across San Bernardino County, California, through the Gold Roads District, and eastward in Mohave County, Arizona, beyond which it is complicated and obscured by the later geologic history. The western end of the tract, in Kern County, has yielded satisfactorily in some cases where experienced judgment has been employed. The developments are largely in the region tributary to Mojave.

There are at least two other east-west gold belts of very similar geologic structure, which have justified development, although the record of the past year has been of less pronounced activity. One belt courses along the southern edge

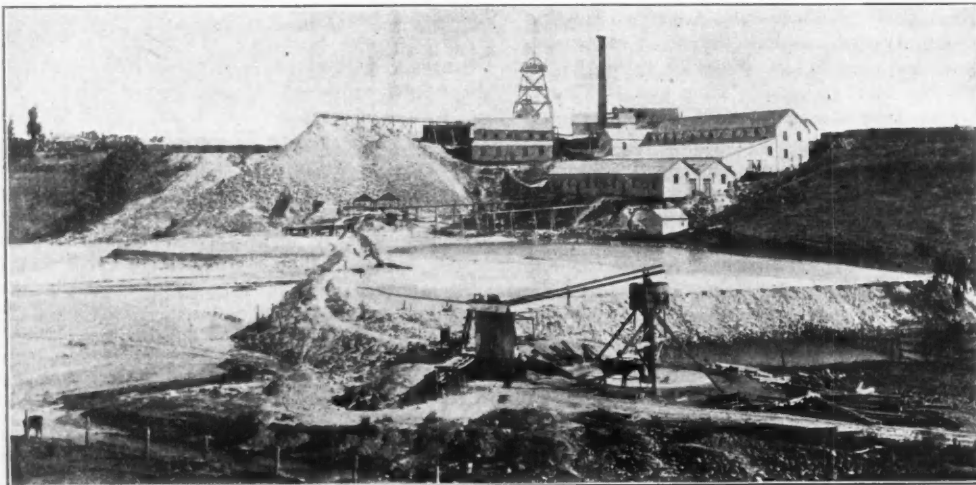
Pearce Mine and mines of the Dos Cabezas District, are in the southern trend. Variations in the outcrop are due to changes in geologic environment, but comparatively few are dissociated with volcanic disturbances. The chances of future important discovery are excellent, for there is no doubt of the continuity of the belts, as the unoccupied gaps are unexplored, are too deeply buried by detritus or obscured by subsequent dynamic influences. At La Fortuna, the encountering of one of the faults common in the region has somewhat interfered with this year's output.

There has been no diminution of output from most of the working gold mines, and new producers have appeared. There are many others which might be made to pay well under business management. One hindrance has been undue reliance upon the cyanide process, in cases where it is inapplicable in whole or in part, coupled with the greedy acceptance of new methods of reduction and novel forms of machinery. Hundreds of thousands of dollars have gone into ill-advised projects of this kind within the last year. All of this fruitless investment might have been spared by the outlay of very moderate sums for competent advice. In fact, not a little was expended in direct contravention of advice given.

Perhaps the greatest interest now attaches to the Searchlight District, with some excitement westward in and about Providence Mountains. There has been an unusual amount of work south

* The Geology and Vein Phenomena of Arizona. Theo. B. Comstock. Transactions American Institute Mining Engineers, Vol. xxx, 1900, pp. 1038-1101.

of the main line of the Santa Fe Railroad, still farther west in California. Captain De La Mar is operating in this region on a smaller scale than is warranted by the conditions. Others are developing with more or less skill, and these have induced the formation of some companies whose agents have been exploiting the public more than the mining locations in hand. Actual returns in dividends have been coming from others, and there is certainly a most encouraging outlook for judicious investment in a wide tract, as yet but moderately explored.



THE STAR OF THE EAST MILL AT BALLARAT, ANSTRALIA.

Randsburg has also shown greatly increased output this year. The Gold Roads District is attracting much attention. In all the area of the true gold veins, as previously mapped out, there are occasional showings of high-grade ore and the basis of a permanent industry is becoming evident, notwithstanding the waste of money and effort which has often characterized initial developments.

The Silver-Lead Regions.—A large portion of Southeastern California and the greater part of Arizona are traversed by that class of structure which yields suitable conditions for the accumulation of argentiferous galena and associated ores. In general terms, the northwest-southeast fault fissures are the loci of this material. Both lead and silver have presented such untoward market conditions of late that only the richest grades have been profitably worked. Consequently, there have been but few new producers, and many of those formerly worked are now idle. The trade conditions necessary for heavy output are non-existent, and few can be economically worked upon a small scale. There is no other limitation to the yielding capacity of the mines, and new fields would rapidly develop under the influence of better conditions. Some hope has been engendered in certain camps by the introduction of local custom smelters in the belief that costs of transportation will thereby be sufficiently reduced to affect the diminished market value of the product.

The Chloride District in Mohave County, Arizona, has for years been one of the most promising of the lead-yielding camps, but it has never had the benefit of abundant capital, and shareholders with nerve enough to see their ventures through to the end. Trade conditions are now adverse to any but the high-grade properties, and these are making steady progress. Those which lie in the direct path of the east-west gold belt are enabled to hold their own, and the final outcome of the district cannot but be favorable. The recent attempt to "vulcanize" the camp, that is, to smelt the ores at a custom smelter of the Vulcan brand, was made in opposition to the advice of several thoroughly competent engineers.

The Copper Resources.—There has been moderate progress over the field to which this article

is restricted (Southern California and Western Arizona), but the actual work now in hand is very meager.

In California considerable exploration took place formerly at the Ivanpah mines, in San Bernardino County, on a belt which is presumably the structural equivalent of promising deposits in Northwestern Arizona, and which may extend southwestward into other counties of Southern California, where some outcrops have recently been discovered.

There are important outcrops along the Santa

Maria River, on the line of Mohave and Yuma Counties, in Arizona, at and near Planet. There has been some development at the old Planet mines, with the aid of Boston capital, with results not yet made public. Here and there across the country in Southern Arizona, there are many apparently isolated patches, north and south of the Southern Pacific Railroad. These are really connected in geologic origin. Several extensively opened properties lie in the region, among which are the Ray and the Silver Bell mines.

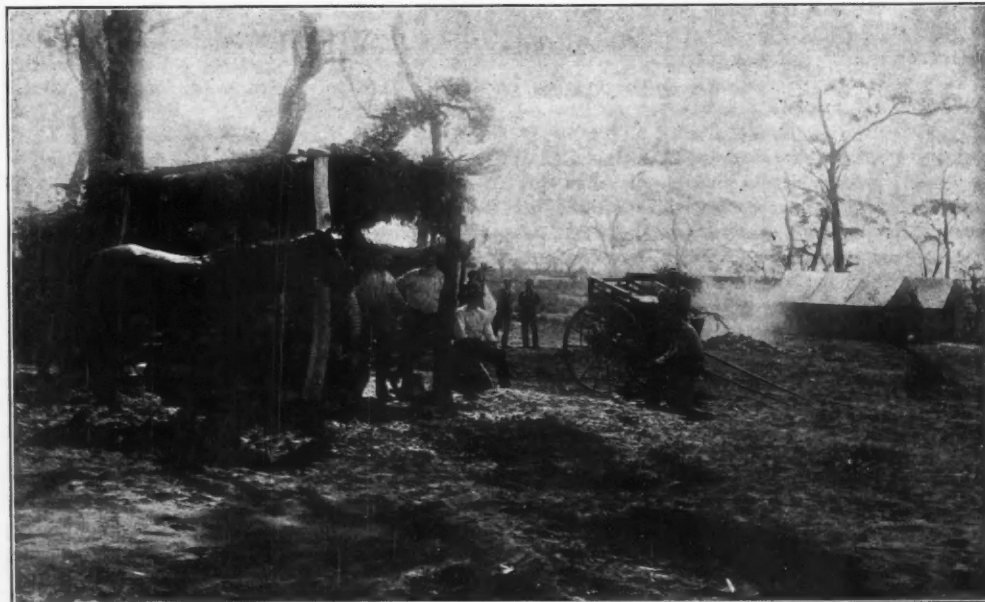
The year 1902 has been a quiet one for the

Some exploration of new fields in Southern California has resulted in exposure of very moderate indications of copper, as yet not conclusive as to quantity available. The showing thus far is but meager and not of a character to encourage investment. The occurrence of the ore is unlike that of the producing districts.

High-Grade Silver Ores.—Another camp with a record of output followed by a crop of wildcats is the much-advertised Tonopah District in Southern Nevada. This lies exactly in the path of the great Comstock-Tombstone belt, closely identified with the great northwest-southeast fault system, extending from Nevada to the State of Durango, Mexico, via Arizona. Undoubtedly a few very promising mines—a very few promising mines—are eligible within a certain area of this tract, but there has not yet been development enough to determine the real future of the district. The developments of the principal properties in this district are being carefully watched by experienced investors.

This class of ore, having usually resulted from secondary action, is of very uncertain distribution. The deposits are like the ores of Silver King, Arizona, in many respects. There are some of the same kind in Mohave County, Arizona, in the Chloride District, and the White Hills District was kept alive for several years on somewhat similar output, although this last was more closely allied to the surface ores which gave Tombstone its early boom.

Tombstone is taking on renewed activity, with gigantic strides, not by reason of new discovery, but simply because abundant capital is being employed under the advice of thoroughly competent engineers, wholly familiar with the conditions. It is not that the ores in depth have become richer, but that the requisite combination of talent and money is being applied, after the most thorough scrutiny, by experienced engineers. The same method diligently pursued at many other points now struggling under amateur management with absurdly inadequate capital would soon completely revolutionize the mining industry. A long step towards the realization of this end will be taken whenever the capabilities of



IN THE AUSTRALIAN BUSH.

most part with these holdings, the reasons therefor being not generally understood by outsiders. But in all of them there are structural features which so complicate the development that the common method of attack often results in "gophering," which leaves the property in bad shape for future work. The first requisite in development is to obtain a clear understanding of the geologic structure, a point rarely considered, if at all understood, by the average operator.

the Colorado River, as a source of power, are practically employed in generating electric energy.

The Oil Situation.—As in metal mining so in the oil industry there is weeping and wailing among those who invested not wisely but too deeply in lottery stocks. It all depends from which side of the fence one views the outlook, whether the conditions be regarded optimistically or otherwise. The actual producer and the

regular consumer need have little misgiving as to the future, for the day of small things is gone, and gradually the business footing is being established. The low price of fuel oil and its abundance have come as boons to manufactures and the mining industries, so that the demand has been steadily growing. The railroads now use enormous quantities, and the conditions of transportation are such that, all in all, there is a very fair promise of better times for large producers. The smaller operators cannot compete successfully at present prices, and combinations of the larger ones tend to promote economy in pumping, distribution and marketing, as well as to limit undue output, in a measure. Meanwhile, there is little inducement to extend the known limits of the fertile ground and the ample fields of Kern County continue to hold the palm for yield in Southern California. Los Angeles County has always confined its trade to the home market, Arizona being largely supplied from Bakersfield and the adjacent tracts. Much money has been wasted in Arizona in attempts to get oil where no possible chance exists. Some borings have more reason, or at least the adverse chances are a little less evident. There are also a few untried fields in remote portions of Arizona and Nevada where the actual discovery of oil would be a great boon to the local mining industry. But careful examination by persons capable of distinguishing more than topographic resemblances is essential as a preliminary step. This work is very rarely done, or it is accepted at the hands of interested examiners, whose bias is always favorable to drilling in any event.

Aside from the advantage of securing near-by supply of fuel to reduce cost, there can be no present object in tapping new reservoirs of oil. The yield now is so much in excess of demand that production is to some extent a waste, and no true citizen can desire to exhaust our natural resources prematurely. I think it may well be said then that it is a sign of progress for the year 1902, that there has been a tendency to curtailment of excessive output and a weeding out of watered stocks. True, there has been some transfer of the bubble methods to metal mining, but that, too, will be short lived by reason of the lesson taught in oil.

As to the permanency of the supply, we may well consider the evidences of the borings in the most productive fields. These indicate very long continuance of output, although certain districts have already become exhausted or uneconomical under present market conditions.

There are also good geological indications of such possible extensions of the present fields as to leave little prospect of an early shortage, provided that the resources available be judiciously husbanded. The business arrangements effected by the most long-headed operators appear to tend rightly in this direction. The statistics of oil production of Southern California districts for 1902 will bear thoughtful study.

Other Mineral Products.—The building interests of Los Angeles and surrounding territory have been remarkably active in 1902, and the construction of the San Pedro Harbor has likewise called for unusual productions of stone. Lime, sand, gravel and asphalt have been abundant at home or within easy reach. Much attention has also been drawn to the deposits of niter and borax and other salts which occur in the desert regions of Southern California. Prof. Bailey's report, under the auspices of the State Mining Bureau, is directly responsible for this recent interest. There is still much to be done in a practical mining way before the extent and quality of these accumulations will be fully known. Borax continues to be mined vigorously at the points heretofore active. The manufacture of common salt by solar evaporation has been common since the war, and the industry meets most favorable conditions of cost

and quality of output in the vicinity of San Pedro, where sea water is now being evaporated on an extensive scale.

Placer mining for gold has continued desultorily, with but little progress in our districts, although great calculations have been made for the industry of dredging in the Colorado River bed and in a portion of the Hassayampa drainage in Arizona.

Periodic booming of tin mining recurs as usual, gaining momentum as reports journey eastward, but practical results thus far have been absolutely nil.

Conclusion.

Finally, the sum total of development of mineral resources has been decidedly gainful. There is abundant opportunity for the investment of capital in legitimate enterprises and the successful earning of fair dividends by experienced operators justifies the statement that the resources of the Southwest are ample and well placed for economical working. Trade conditions are constantly improving in the directions of reduced costs and enhanced income. But while every encouragement is thereby afforded for legitimate business-like undertakings, the opportunity for unloading undeveloped property upon the undiscerning public is now all but passed. To the discerning ones who make money in actual mining, the pendulum has swung to the right point for action. There is every reason to believe that we shall have more real mining progress in 1903 and far less newspaper advertising of promotions.

PROSPECTS FOR THE SALE OF MACHINERY IN EUROPE

During a recent trip abroad the writer visited the principal mining districts of Great Britain, the European Continent, and also the northern coast of Africa. After careful study of the market conditions in these countries, it seems safe to assure our manufacturers that there is still room in Europe for American machinery. However, we must cultivate these foreign markets, and we must seek this trade even more energetically than we do in this country, for we have to struggle in foreign fields with powerful competitors who have the advantage of being stronger in their foreign sales department than we generally are.

A few notes will demonstrate what we should especially be able to supply in the various countries referred to.

Morocco offers a limited market for hardware and small tools. In Tunis and Algeria, the phosphate industry requires modern machinery. In these two countries, however, we have the French tariff against us. Spain, it is believed, mining machinery, gas and gasoline engines, light machine tools, electrical machinery, saw-mill and woodworking machinery, rolling stock and railroad material, and general mill supplies. In Portugal, there is a fairly good demand for general industrial machinery and small tools. In France we should be able to introduce, to good advantage, conveying and hoisting machinery, electrical appliances, tools and steam fittings, pumping machinery, air-compressors, gas motors and general mining machinery, chiefly for coal mining. Belgium offers a good field for coal mining machinery and supplies used in connection with this industry. There is also a fair demand for machine tools and general mill supplies. There is very little of American manufacture to be seen in the Grand Duchy of Luxemburg, which is one of the principal iron ore producing centers of the Continent. Holland has no mining industries, but does a large trade in all kinds of industrial machinery and supplies. Of the Scandinavian countries, Sweden should offer an excellent field for iron mining machinery; in Norway there is a good demand for electrical and saw-mill machinery, while Denmark presents good opportunities for the sale of light machine-tools, mill supplies and railroad material. Germany and Austria-Hungary are at

present undergoing a severe industrial crisis. In spite of this, however, there is still a fair demand for all kinds of industrial machinery. The prospects in Italy are much better; this country is making rapid progress in its industries. In northern Italy there is chiefly a demand for machine-tools, woodworking machinery, small tools and electrical machinery; the mining industries are centered on the islands of Sicily (sulphur), Sardinia (calamine and lead), and Elba (iron). Improved tools, such as crowbars, screw-jacks, pikes, chisels, shovels, saw-plates, hammers, etc., could be sold for use in the great marble industry of Carrara. We should be able to do a far larger trade with Switzerland, especially in the machinery used in engineering, as well as in general supplies for mills and railroads.

In most of these countries the great bulk of machines, tools and supplies in use—with the possible exception of machine tools and agricultural implements—is not of American origin. There is no prejudice against American goods, though many importers complained bitterly of the way they had been treated by American manufacturers. The chief complaint, which is to be heard all over Europe, was that we do not care at all for foreign orders as long as we are kept busy at home. Many firms told me that they had spent a considerable amount of time and money to introduce new American machines, and after a demand had been created the machines could not be obtained from the manufacturer, the latter simply "regretting his impossibility to accept export orders on account of his works being crowded with domestic orders." Such a business routine makes bad blood and regains the field for our foreign competitor.

FREIGHT RATES ON THE LAKES.

The following interesting table of freight rates on the lakes for three years past has been prepared by the *Marine Review*, of Cleveland, Ohio. The rates on iron ore, it may be noted, are for gross or long tons; those for coal on net or short tons:

Average Daily Rates of Freight on the Great Lakes.

	1900. Cents.	1901. Cents.	1902. Cents.
Iron ore, Escanaba to Ohio ports....	69.5	63.9	58.8
Iron ore, head of Lake Superior to Ohio ports	84.5	89.3	77.2
Iron ore, Marquette to Ohio ports..	78.3	78.7	66.1
Soft coal, Ohio ports to Milwaukee...	45.4	48.9	46.7
Soft coal, Ohio ports to Duluth.....	40.2	38.3	34.5
Soft coal, Ohio ports to Portage....	41.3	39.5	31.8
Soft coal, Ohio ports to Manitowoc...	43.6	48.1	41.9
Soft coal, Ohio ports to Sheboygan...	43.6	45.3	41.9
Soft coal, Ohio ports to Green Bay..	45.0	48.7	46.7
Soft coal, Ohio ports to Escanaba...	40.0	46.0	41.4
Hard coal, Buffalo to Milwaukee....	48.5	50.2	42.3
Hard coal, Buffalo to Chicago.....	48.5	50.2	42.3
Hard coal, Buffalo to Duluth.....	39.5	38.4	32.8

The *Marine Review* comments upon the facts shown as follows: "Earnings of the lake freighters in the season just closed have been about the same as in 1901, notwithstanding the great delays in port, especially at the ore docks of Lake Erie. Of course, there have been some exceptions, but as a rule the big steel ships have been able to divide on the season's work about 10 per cent among stockholders, in addition to retiring the usual portion of bonds. Some of them have even done better. On the other hand, some of the wooden vessels of the older and smaller class have undoubtedly had a hard time making both ends meet, mainly on account of the short coal movement and the delays which they encountered in getting coal cargoes after being chartered.

"The effect of the strike of anthracite coal miners on the lake trade of the past season has probably not been generally understood. It was at first thought that the influence of the strike would be confined to the hard coal movement, which is not a very large item in the lake trade as a whole, and not important compared even with the soft coal movement. But an immediate effect of the strike was to divert soft coal to the districts that had been supplied with anthracite, and it is therefore about right to conclude that the great increase in the lake shipments of iron ore has almost been offset by the shortage in hard and soft coal."

MINING IN WYOMING IN 1902.

By WILBUR C. KNIGHT.

Gold and Silver.—There was no marked advancement made in gold and silver mining in Wyoming during the year. As usual, the Sweetwater District furnished nearly all of the gold and silver mined in the State. The approximate amount cannot be given at this time; but it will not exceed \$50,000. In the Wood River District, near Kirwin, Big Horn County, several companies have done sufficient work so that they are patenting a great many claims. The ores of this camp are lead and silver chiefly, and assays showing upwards of 100 ounces of silver to the ton are not uncommon. At present this camp is too far from transportation to handle successfully the ores. In Crook County there has been quite a stir in the vicinity of Welcome, and not far from the Interocean Mine. Several companies have bonded property, and claim that they expect to inaugurate extensive plans for work for 1903. But little has been accomplished in the other camps of the State.

Copper.—This industry is gradually improving; but this year has been one of development rather than production. The greatest changes have been made in both the Grand Encampment and New Rambler camps. The North American Copper Company purchased the Ferris-Haggerty Mine, the new tramway that had been put in at a cost of over a quarter of a million of dollars to connect the Ferris-Haggerty Mine with the Grand Encampment Smelter, the Grand Encampment Smelter and numerous other valuable rights. It is claimed that the purchase price on the Ferris-Haggerty property was \$1,000,000. This company has commenced extensive development on the mine, is erecting a very large concentrating plant, and is to enlarge the smelter greatly. With these improvements it is claimed that the Union Pacific Railroad will construct a branch into the camp. Other properties have been greatly developed during the year, so that Grand Encampment is taking on an air of permanency that has, prior to this date been lacking. To the southward the Pearl District has been opened upon the Colorado-Wyoming line, and there are several very good copper prospects working.

In the New Rambler District great changes have taken place also. Early in the season this company put in a matting furnace, which made several very successful runs. Later an Eastern company purchased the mine and incorporated it for \$2,000,000. This new organization took over the property early in the fall, and has been pushing development as rapidly as the conditions would permit. It is also talking of enlarging the smelter. As soon as the Laramie & Hahns Peak Railroad, which is graded to a distance of about 25 miles southwest of Laramie, is completed, it will pass within a few miles of this property. There are several companies that have opened very good-looking prospects near the New Rambler, and another season will, in all probability, prove some of these to be mines. The discovery of platinum and palladium in the Rambler vein was of more than ordinary interest, and on account of this a great many have taken a deep interest in the prospects of this entire region. As far as known, the Rambler is the only property that has produced ore carrying these rare metals. From an average of a great many assays the covellite ore runs 3.5 ounces of platinum and palladium to the ton. Sometimes it is all palladium and others nearly all platinum. Although the owners of the Rambler Mine sold about 2,000 tons of this ore they did not receive anything for the precious metals it contained. At Hartville, an old-time copper camp, some very rich ore bodies have been discovered, and from present indications this will add to the copper production of the State for the coming year.

It has been impossible to secure the statistics for the copper production of the State for 1902;

but it can safely be placed at a very much lower figure than for 1901.

Petroleum.—While the product of petroleum for 1902 will not show any marked increase over 1901, this has not been the fault of the development, but the lack of transportation. In reality, the season of 1902 has done more for the oil industry than all work combined, that has been done in the last ten years. The greatest amount of successful work was done in the Popo Agie field, where there are eight producing wells, all of which are spouters, and will produce according to the best obtainable data about 200 barrels each per day. The Henderson Company, which has purchased this section, is proving the lands as fast as it is possible to drill, and expects very soon to have sufficient wells drilled to warrant the construction of a railroad to the field. At Salt Creek the Pennsylvania Company has been drilling nearly all the year, and has added several producing wells; but owing to the lack of a pumping plant, which is being erected, these wells will not add to the production of Salt Creek for 1902. In Uinta County a number of companies have been at work and a few of them have been successful in striking oil. The most of this work has been done in the immediate vicinity of Spring Valley, where the Union Pacific Company struck oil while drilling for water over a year ago. Some 15 rigs have been drilling. Two of these have reached the oil sand and claim a production varying from 20 to 35 barrels per day. One of these companies has a 250-barrel tank filled. On account of cold weather several of the companies have been obliged to suspend operations. The coming season bids fair to be a very important one in the Spring Valley field. Wells have also been started in the other fields of Uinta County; but with the exception of a little oil found near the surface none of the companies have reached the oil sandstone.

Many other fields in the State are receiving attention. At Newcastle, Belle Fourche, Douglas, Powder River and Bonanza, wells have been drilled or are being drilled. At Bonanza a California company completed a well, plugged it and left the country. Those who are familiar with the district maintain that the company struck oil, and that the well would produce not less than 35 barrels per day. Four wells are in progress at Belle Fourche, none of which has reached the sand. At Newcastle there are several wells being drilled. Oil was found in the Douglas field; but the production so far has not been as large as the company desires. Possibly the company at Powder River will bring in a well before January 10. Were it possible for the producing wells in Wyoming to sell their product the petroleum production for 1903 would exceed 500,000 barrels. Late last fall the Belgo-American Drilling Trust sent a representative to Wyoming and has already located and contracted for three new wells upon the great dome east of Rock Springs. This company comes well recommended, and has excellent backing. From the field manager, Mr. Charles Walter, it has been learned that this company expects to drill wells in every oil-field in the State, and that during 1903 they expect to drill a great many wells. On the whole, the oil industry in Wyoming is rapidly coming to the front, and it seems highly probable, with another year's experience, that at least one-half of the oil-fields in Wyoming will be satisfactorily tested, and that the product, provided transportation can be secured, will reach 500,000 barrels per annum, if not more.

MICA PLANT IN OTTAWA.—Consul-General C. E. Turner reports from Ottawa, December 6, 1902, that the Westinghouse Electric Company is about to establish in that city a large factory for the manufacture of mica, having secured land and buildings. To begin with, it will employ from 200 to 300 hands.

THE PETROLEUM INDUSTRY OF CALIFORNIA IN 1902.

By OUR SPECIAL CORRESPONDENT.

Though the consumption of oil increased greatly in 1902 the petroleum industry of California throughout the past year has been in a condition of great depression from the standpoint of both the oil producer the speculator in oil stocks. However, there has been remarkable development in transportation and consumption with every promise of still greater development during 1903. The oil industry is now recognized as a very important element in the rapid industrial and commercial growth of the State of California and of the whole Pacific region.

The year 1901 was characterized by a speculative boom and a great increase in production, the actual output reaching 7,710,315 barrels—an increase which vastly exceeded the consuming capacity of the market as then developed. The inevitable reaction came near the end of the year, when it was realized that the producing wells then drilled were able to supply more than double the amount of oil for which there was a market. There was a sudden end to the boom in oil stocks, and during 1902 investments were made mainly by large capital along legitimate lines. During the last nine months of 1901 there were 2,951,660 shares of oil stocks of a selling value of \$1,487,424 traded at the Producers' Oil Exchange in San Francisco, while the record for 1902 shows but a small fraction of this amount.

The year thus opened with a supply of perhaps 15,000,000 barrels a year in sight, from over 2,400 producing wells. The existing refineries have provided a sustained market for light refining oils, but the heavy asphaltic fuel oil of the Kern County and Los Angeles fields constitutes the great bulk of the output, and early in the year Kern oil, which pays 40 cents for transportation to market, began selling for 10 to 15 cents at the wells. These prices have ruled until recently. A few months ago Los Angeles oil dropped to 35 cents at the wells, but its price has been about 60 cents most of the year. The low prices, and the glut of oil caused the capping of many wells, the number of capped wells on May 1 being over 500. There are now in the State 2,500 productive wells, of which several hundred are capped.

Drilling fell off greatly during the year, and new developments have been mainly in the search for light oils, resulting in the development of two new fields of this character. One is the Santa Maria, in Santa Barbara County, in which the Western Union Oil Company has brought in ten deep wells, yielding a valuable light-gravity oil and advantageously situated for piping to the coast. A nine-tenths interest in this property recently sold for \$1,425,000. In the Halfmoon Bay field close to the sea and 35 miles from San Francisco, productive wells have been developed, and the field promises to be important. The product is a good refining oil of 45° to 52° gravity, and a small refinery is in operation. The search for light oils continues elsewhere in the State. The important Coalinga field in Fresno County, the product of which is largely a light oil, has maintained an even status, though still handicapped by lack of transportation facilities.

The year has been mainly given over to the rapid development of means for the transportation, storage, refining, consumption, etc., of the great supply, already developed. Most significant are the operations of the Standard Oil Company, which has been investing several millions in tanks, in its 278-mile pipe line from the Kern fields to San Francisco Bay, and in its great new refinery at Point Richmond. The company believes it has solved the problem of piping the heavy Kern oils with an eight-inch pipe line and ten pumping stations. The line will be in operation within six months, with an initial capacity of 10,000 barrels a day. Recently the

company contracted with the Peerless Oil Company for 5,000 barrels of Kern River oil a day for five years, and it has made other large contracts. The company will pipe only its own oil for refining and for direct sale for fuel, but the pipe line will release many tank cars for other shippers.

The increased use of oil for fuel is, of course, the great feature of the year. The consumption in this direction has been mainly by the railroads, and in the San Francisco Bay region, which has been enjoying great industrial expansion. In the City of San Francisco 200 power users have secured permits to store and burn crude petroleum, and many of the large industrial plants of the bay region have also adopted it. Coal for steam raising has cost about \$6 per ton, while oil cuts this in half. Imports of coal have been reduced about 50 per cent. Oil, however, has a new competitor in the electrical energy now brought 200 miles from the Sierras.

The Southern Pacific, the Santa Fe and the minor railroad systems have been altering their locomotives to use oil fuel. The Southern Pacific now has 504 engines burning California petroleum, and is adding others as fast as possible. At the average consumption of 600 barrels per engine per month, this company is now using 3,600,000 barrels per year. Throughout its system it is erecting storage tanks to hold a six months' supply. On all roads running in and from California about 1,000 locomotives are now using oil at the rate of between 6,500,000 and 7,000,000 barrels per year, or nearly the output of 1901, and this consumption will largely increase during 1903.

One of the most striking and promising developments of the year has been the adoption of oil fuel for marine boilers. The Federal authorities have granted 105 permits to vessels of all classes with a total tonnage of over 90,000. The vessels are mainly bay, river and coasting craft, but the *Enterprise*, of the Watson Navigation Company, in April made a successful run to Honolulu and return with oil fuel. In July the *Mariposa*, of the Oceanic line, 3,180 tons, made a long trip with oil fuel to Tahiti. Lieut. Ward Winchell, of the Navy, accompanied the vessel, and his report of complete success greatly stimulated the use of petroleum in Pacific Waters. During recent months several ocean-going steamers have become oil burners, and more soon will be. Next season oil fuel will be used on the Yukon River steamers of the Northern Commercial Company. During the year seven oil transports have been put into operation to and from San Francisco, making nine altogether, with capacities of from 6,000 to 30,000 barrels. More are to be provided soon.

In this connection the recent explosion of an oil tank in the steamer *Progreso*, which was being made into an oil transport for the Atlantic trade, at San Francisco, is important. The explosion was evidently caused by the ignition of gas generated in a nearly empty tank. It destroyed the steamer and killed 14 persons. The oil was a mixture of light and heavy, with a low flash test, and the tank was not properly ventilated. It is not thought that the disaster will retard the marine use of oil, but that it will lead to proper precautions for safe storage and use.

The shipment of California fuel oil for Hawaii and Puget Sound, and other coast districts, is rapidly increasing. The Standard Oil Company is erecting large storage tanks at Tacoma, and many will be erected elsewhere. During the year storage for several millions of barrels has been provided in the fields and at points of consumption.

The number of oil refineries has increased from 11 in 1901 to 33, and soon several million barrels per year will be refined. The new refinery of the Standard Oil Company will, it is stated, be the second largest in the United States. Other refineries, some of large capacity, have been erected

near San Francisco and Los Angeles, and in San Joaquin Valley. The heavier oils, as well as the lighter, are being treated, and the increase in the production of asphalt, a residuum of the heavy oils, is rapid. A small percentage of illuminating oil is one of the products of distillation at some plants, but its poor quality requires mixing with Eastern petroleum, and until a supply of paraffine oil is developed this product will be of minor importance in California.

The Selby Smelting Works on San Francisco Bay now uses crude oil in 47 roasting and reverberatory furnaces, with a fuel saving of 50 per cent. It is also used at the Shasta County copper smelters. The problem of its use in blast furnaces continues to excite local interest.

In the above and other ways the consumption of California petroleum probably amounted to 12,000,000 barrels in 1902, according to the estimates of Secretary C. T. Deane, of the California Petroleum Miners' Association, and may easily reach 20,000,000 barrels in 1903. The consumer has thus nearly overtaken the producer. Within a month there has been a noticeable stiffening of prices of oil stocks, and of oil prices. Within a few weeks oil has sold at the wells in the Kern River field at 25 cents or more per barrel, in spite of the enormous productive capacity of the field, and better prices are expected throughout 1903. The Southern Pacific Railroad Company has ordered 600 new tank cars of large capacity, and with about 2,500 cars in use in the State and the completion of the Standard's pipe line, the marketing of the product will be facilitated greatly.

One of the events of 1902 was the organization of the Associated Oil Company by the combination of about 30 producing companies of the Kern County fields. The future of the combination and its relations to the Standard Oil Company are matters of speculation. It has talked of an independent pipe line, and it has authorized an issue of \$5,000,000 in bonds. The Union Oil Company, next to the Standard the largest producing and refining company in the State, has invested largely in Kern fields and erected a refinery at Bakersfield.

Various large projects have been talked about, but remain inchoate. One is a railroad from the Kern fields to the coast, and another is a pipe line from the Coalinga field across the Coast Range, 125 miles, to the coast. W. H. H. Hart has been for some months promoting a syndicate of Eastern and foreign investors with \$10,000,000 capital to acquire extensive Kern properties, build a large refinery on the bay, make coke for smelting iron and manufacture steel. It has not reached the stage of operations. An effort to combine the companies of the Summerland field has so far failed.

COLORADO PETROLEUM IN 1902.

By Our Special Correspondent.

The production of petroleum and by-products has been disappointing when the expectation aroused by the extensive prospecting in different parts of the State is considered. The net result of the season's development is to demonstrate but one new field of sufficient importance to be considered a factor in the oil business of the State. Boulder County went through a premature oil excitement on the discovery of a limited amount of oil in the Arnold and McKenzie wells. Companies were organized by the score and in many instances with extremely flimsy assets. A good many thousand dollars were thus invested, which up to date have yielded no return, though a score of small producing wells were obtained, the total flow of which for the year has been estimated at 10,000 barrels, worth on an average of 90 cents a barrel at the well. The United Oil Company, a local organization, is at present the sole buyer and furnishes storage tanks for producers.

Prospecting in the southwestern and western portions of Colorado is still persistent, numerous surface indications having stimulated activity. In Mesa County, near De Beque, oil was encountered by one company at a depth of 600 feet; but the flow being deemed insufficient, boring was continued to a depth of 1,300 feet, when a strong flow of salt water was encountered and the hole was abandoned. The Florence field produced during 1902 500,000 barrels of oil, having an approximate value of \$600,000. The refinery at Florence has a capacity of 1,000 barrels a day, and with what is sold crude and for fuel takes the entire output of the field. There has been no extension of note in the Florence field, because the United and a smaller company occupying that section do not care to force the production beyond the needs of the market, and encroach on the territory of the Continental or Standard Oil Company.

PRODUCTION OF ZINC IN AUSTRIA.—According to the official statistics the output of zinc ore in 1901 was 36,072 metric tons, which was 2,170 less than in the previous year. The production of spelter was 6,975 metric tons, an increase of 837, and of zinc dust 584 tons, a decrease of 20. Of the ore production, 3,141 tons came from Bohemia, 267 tons from Styria, 23,211 tons from Carinthia (chiefly from Raißl), 4,618 tons from the Tyrol, and 4,836 tons from the Chrzanow District in Galicia. Of the spelter production, the three works in Galicia made 48.74 per cent, the works at Cilli in Styria 41.13 per cent, while the remainder was made at Sagor in Carinthia. The last was run largely on ore imported from Auronizo, Venetia, Italy, and the three Galician plants smelted chiefly ore from Prussia.

THE PHOSPHATE INDUSTRY IN 1902.

By Charles C. Schnatterbeck.

The past year has witnessed many important changes in the phosphate industry, not only in America but in foreign countries as well. Everywhere there was manifest a tendency to centralize control in mining and marketing phosphates, and some effort was also made to consolidate the leading superphosphate manufacturers in Europe. In the United States the syndicate idea has received much attention, especially in the high-grade rock districts of Florida and Tennessee. Reason for this is found in the fact that the deposits of high-grade rock are limited, no new discoveries having been made in some time, while the older mines are gradually being worked out. An attempt is being made to lengthen the life of the older mines by dredging where the water level is near the surface, but this means will only temporarily keep up production. Authorities are unanimous in expressing the opinion that it is only a question of time when the deposits will be exhausted.

Exploration for new phosphate ground has been active, and the discoveries made have warranted the investment of new capital. Good prices have been obtained for land, but speculative buying has fallen off materially. There have also been many transfers of old properties, and the most important options have been taken by the fertilizer combinations, which are gradually becoming independent by controlling their own supplies of raw materials.

Production of all grades of phosphates in the United States in 1902 was heavy, notwithstanding the interruptions in mining by bad weather, scarcity of labor and delayed transportation. In all there were produced during the year 1,580,997 long tons, which compares with 1,503,623 tons in 1901; showing an increase of 77,374 tons, or 5.1 per cent. The shipments have also increased, being 1,630,809 tons, or 139,346 tons (9.4 per cent) greater than for 1901. On the other hand, the

shipments in 1902 were 49,812 tons larger than the production, which indicates a better statistical position for the industry. The exports, chiefly to Germany, Belgium and Great Britain, amounted in 1902 to 827,230 long tons, while the domestic shipments, principally to Southern consumers, aggregated 803,579 tons; both shipments show nearly the same increase over the year 1901. The increase in exports has been due to the scarcity of basic slag, which is used largely in Europe as a fertilizer ingredient, while the American increase in the consumption of phosphate is attributed principally to the cotton growing industry.

While it is gratifying to see an increase in the marketing of phosphates during the year just closed, it should also be said that prices, owing to aggressive competition, have suffered severely. At home there has been little chance to meet the competition, but abroad our exporters have taken advantage of the low ocean freight rates.

In forecasting the future of the industry it is interesting to note that although many large orders have already been booked for next year's delivery at rather low prices, others are pending, as miners are determined to hold out for higher prices.

FLORIDA.

The year 1902 has been an eventful one for this important phosphate State, in which considerable American and foreign capital has lately been invested. The production of all grades of phosphate this year amounted to 839,345 long tons, which compares with 751,996 tons in 1901; showing an increase of 87,349 tons, or 11.6 per cent. Shipments in 1902 were about 25,000 tons greater than the production. This increase is due to several causes—the erection of new plants, working of virgin ground (not new deposits recently discovered, but land held in fee by the larger companies), and a heavy export trade, facilitated by improved rail and water transportation and low ocean freight rates. Strict economy in production is now practiced, especially in the hard rock region where dredging is being tried to prolong the life of the deposits. Many plants are also using Texas oil as fuel.

The labor supply has been shortened by the withdrawal of the convicts. Three large mining companies had employed from 800 to 1,000 prisoners, paying the State a comparatively small fee for the privilege.

Real estate transactions have been very extensive this year, and prices obtained have been generally satisfactory. It is noteworthy that the new owners intend to mine and not speculate in the property. Much land has been taken up by the big fertilizer combinations who are increasing their supply of the raw material.

Attempts at a combination of the hard rock producers have proved futile. Only five of the larger miners accepted the agreement to maintain f. o. b. prices, and thus regulate the export market. The scheme, although not yet popular, has helped to lessen the difference between the f. o. b. and c. i. f. prices, while the sales made direct to manufacturers of superphosphates has reduced speculative buying abroad.

Briefly, the business policy of the mining industry is better to-day than it has been for a long time past.

Hard Rock.—It may be surprising to learn that no new deposits of high-grade rock have been discovered this year, notwithstanding the newspaper reports to the contrary. The land being worked as "new" has been held in fee for a long time by companies that are removing their plants from deposits believed to be cleared out. In some cases dredging is being resorted to by these companies to recover the rock under water level. An attempt has been made to force the water out of the mines by means of centrifugal pumps, but this method is not only too expensive, but frequently the water will find its way back to the pits again. On the whole, the closest economy is being practiced in mining hard rock, as it is only a

question of time when no more high-grade stuff will be available for working. In the past year the increased production amounting to about 450,500 tons was favored by unusually dry weather, and improvements in railroad transportation, coupled with the opening of a new shipping port—Port Inglis—in September, resulted in increased exports. The first cargo of 3,302 tons was shipped through Port Inglis by the Dunnellon Phosphate Company, and was destined to Germany. The total exports of high-grade rock in 1902 was 484,000 long tons (chiefly to Germany, Great Britain and Belgium), as against 424,130 tons in 1901; showing an increase of 59,870 tons, or about 14 per cent. None has been sent to domestic markets this year. Selling prices abroad were somewhat lower than in 1901, owing to competition, not only among exporters but also among sales agents who handle the Algerian and other foreign phosphates. From January to March the c. i. f. price at United Kingdom and European ports averaged \$11.12 per long ton, while in September it fell to \$9.87, closing in December at \$9.77, and making an average for the year of \$10.36, as against \$11.45 in 1901. The f. o. b. prices did not fluctuate as widely, owing to the gentlemen's agreement among five of the more important producers and exporters. In January up to \$7.50 was quoted f. o. b. Fernandina, and from May to early December the average was \$6.75, but later it was \$6.25, while for the year it was \$6.95, as against \$6.83 in 1901. Ocean freight rates, which have an important bearing on the export trade, were demoralized, owing to aggressive competition among the various shipping interests. The rates from Florida and Savannah, Ga., were: Continental ports, \$3.40 in March, \$3.72 in September and \$3 in October; Baltic, \$3.42@3.96; Mediterranean, \$3.34@3.60; United Kingdom, \$2.55@3.12.

Special mention should be made of the numerous important real estate deals that were made during the year. These were nearly all at good prices, and were credited to substantial mining companies. The fertilizer combinations have also been active buyers, as they are the largest consumers of phosphate, and being heavily capitalized need to manufacture economically and so wish to control their raw material supply. A number of new plants have also been erected during the year, especially near Hernando, and other important phosphate centers, the owners being outside capitalists whose interest in the industry is increasing.

At the opening of the year 52 plants were at work, while stocks which were mostly under contract for delivery were some 50,000 tons less than on January 1, 1901. Since then the number of plants has been increased, and as sales have been large stocks at the end of the year show a falling off, notwithstanding the heavy production. It is also noteworthy that the sales for 1903 delivery are enormous, but at rather low prices. Moreover, speculative buying is being cut short by the intention of the leading miners to deal direct with the manufacturers of superphosphate in foreign markets. Summed up, the industry is in better shape than a year ago, and economical production will doubtless overcome the lower selling prices.

Land Pebble.—The land pebble district in Polk County has witnessed active mining, a larger consumption but lower prices than last year. Competition has been aggravated in the foreign market by the cheap Algerian phosphates. The production of land pebble was approximately 368,845 long tons, as against 252,958 tons in the previous year; showing an increase of 115,887 tons in 1902. Shipments from Tampa in 1902 were 345,344 tons, or 71,750 tons larger than 1901, due chiefly to the home demand. The exports were 143,015 tons, principally to Italy, France and Germany, which compares with 114,229 tons in 1901; showing an increase of 28,786 tons. The domestic shipments were 202,329 tons in 1902, as against

159,365 tons in 1901; an increase of 42,964 tons in the past year. In addition to these shipments about 30,000 tons have been sent by rail to the interior in 1902. The f. o. b. price held throughout the year at \$3 to \$3.25, making an average of \$3.13, which compares with \$3.79 in 1901. Abroad the c. i. f. prices fluctuated between \$6.65 and \$8.40, making an average of \$6.96 for the year, as against \$8.52 in 1901. The ocean freight rates from Port Tampa to Europe were the same as quoted on Florida hard rock, as noted above. An interesting charter was taken in September to Yokohama, Japan at \$5.52, sailing in January, 1903. This rate is \$3.48 less than was booked in February, 1901, when the last shipment was made.

Nine land pebble plants were operating on January 1, 1902. Since then new plants have been erected, and land sales have been large, the purchasers in many instances uncovering good material. On November 21 the extensive plant of the Land Pebble Phosphate Company, located near Bartow, was destroyed by fire.

To economize, various plants are using Texas petroleum as fuel. The first to try this fuel was the Prairie Pebble Phosphate Company, and the Standard Oil Company, anticipating a larger use, has erected storage tanks at Port Tampa to supply the mines.

In the Peace River section a disastrous fire visited the plant of the Peace River Phosphate Company, which is now controlled by the American Agricultural Chemical Company, the Northern fertilizer combination. The entire property of the Peace River Company located at Hull, was burned on January 10, but a new plant has since been erected which, owing to the improved methods of handling can prepare a better quality of pebble. Notwithstanding the fire, mining was continued, and the product, believed to have been about 20,000 tons, was taken by the American Agricultural Chemical Company, although 5,215 tons have been shipped elsewhere. In 1901 the shipments were 46,813 tons, and the production, 26,551 tons.

TENNESSEE.

The phosphate industry of Tennessee was disturbed early in the year by heavy storms and a scarcity of labor, which stopped mining for a time; a lack of necessary teams for hauling the rock from the mines, and also rather high railroad rates to the export shipping port. As the year advanced, however, these conditions were changed for the better, and the Louisville & Nashville Railroad reduced the freight rate from Mt. Pleasant to Pensacola, Fla., about 70c. per ton. The total shipments in 1902 amounted to 437,500 tons, of which 139,500 tons were export rock, chiefly for Italy, France and England, and the balance, 298,000 tons, domestic. The shipments in 1901 aggregated 409,653 tons, of which 164,389 tons went abroad, and 245,264 tons were consumed in America. Compared with 1902 this statement shows that the domestic shipments in the past year have increased 52,736 tons, while exports fell off 24,889 tons. It is estimated that the production in 1902 amounted to 429,902 tons, which, compared with 1901, shows a marked improvement. Stocks at the end of the year are much less than 1901, as orders delayed early in the year had to be filled before the close. Prices, f. o. b., have been better than 1901, owing to the business understanding between the larger companies in the Mt. Pleasant field, which produces the greater quantity of rock. Export prices, however, have suffered from the keen competition with Florida rock and the higher grades of foreign. In January to April, inclusive, export rock (78 to 82 per cent bone phosphate of lime) sold f. o. b. Mt. Pleasant at an average of \$3.50 per ton; in May at \$3.75; June, from \$3.25@3.75, and thereafter at \$3.25@3.50; making an average for the year of \$3.47, which compares with \$3.33 in 1901. Abroad the selling prices were \$10.53@10.92 from January to March; \$9.48@10.27 in April, and \$8.58@9.36 thereafter, making an

average for the year of \$9.48, against \$10.76 in 1901. Domestic high-grade rock (78 per cent) sold f. o. b. Mt. Pleasant between \$3@3.25, making an average for the year of \$3.13, against \$2.97 in 1901. Domestic, 75 per cent rock, brought \$2.75@3, or an average of \$2.88, f. o. b., against \$2.74 in 1901. Rock carrying from 70 to 74 per cent bone phosphate of lime sold at \$2.10 to \$2.40, which compares with \$2 to \$2.75 in 1901.

New capital has been invested in the industry during the year, and much ground has been taken up by the big fertilizer manufactures, notably the Virginia-Carolina Chemical Company and the Federal Chemical Company. This would indicate that the power of control in the industry is being centralized, which fact is also emphasized by the transfer of some of the more important mining companies to a few of the larger concerns. It is also evident that as the deposits of high-grade rock are limited and no new discoveries are likely to be made, and as some of the best land is owned by large consumers of the material, export trade will eventually give way to the growing domestic demand.

Mt. Pleasant, in Maury County, continues to be the largest producer of high-grade rock, while mining in other sections is comparatively small, though there are indications that the production will be increased in the near future. Operations have been begun on Bear Creek, where the Tennessee Chemical Company has already taken out several thousand tons of good rock. The Beech River Phosphate Company has been incorporated with \$150,000 capital to work some 4,000 acres of land in Deatur County, while the Southport Phosphate Company, capitalized at \$200,000, in which the Federal Chemical Company has largest control, has opened property near Southport. The Federal Chemical Company has also gained control of the Tennessee Phosphate Company, which has 1,300 acres of the finest phosphate property in the Mt. Pleasant fields. The Sumner Phosphate Company, after several months' idleness, resumed work at Gallatin. At Mountain Junction the Poe property, discovered about three years ago, has been opened for development. The Virginia-Carolina Chemical Company is now the owner of the extensive properties of the Howard, Ridley and Arrow companies near Mt. Pleasant. The Florence Iron, Phosphate and Railroad Company has issued \$300,000 bonds, and has begun the construction of a railroad from Florence to Mannie, which, when completed, will enable the development of some good phosphate land in that section. There were other smaller transactions in which local capital was chiefly interested.

Summed up, the industry is in a healthier condition to-day than it has been in a long while, and as miners have booked larger future orders than heretofore, it is believed that the year 1903 will show a further improvement.

SOUTH CAROLINA.

Mining has been curtailed by the dismantling of the Coosaw works, and by the smaller consumption. In 1902 the production was 285,625 long tons, as against 321,181 tons in the previous year; showing a falling off of 35,556 tons. The shipments approximated 302,625 tons, which shows a decrease of 18,556 tons, as compared with 1901. The exports in 1902 were about 55,500, against 45,709 tons in 1901, and the domestic shipments, 247,125 tons, as against 275,472 tons. The exports have been principally to France and Great Britain. Prices, f. o. b. Ashley River, S. C., averaged \$3.25 per ton for land rock, while river rock sold at \$1.75@3; both prices showing a fall from last year. Abroad the market has also been weaker, prices c. i. f. being quoted from \$5.67 to \$6.30, making an average of \$5.98 for the year, as against \$6.88 in 1901. Competition with Florida land pebble and Algerian phosphates explains this drop in prices. Ocean freight rates

were \$2.64@2.94 to France, and \$2.40@3.12 to Great Britain.

NORTH CAROLINA.

The annual production of the Castle Haynes phosphate mines was increased to about 25,000 tons in 1902, all of which has been used for macadamizing the streets of Wilmington.

PENNSYLVANIA.

The Ross Farm, in Juniata County, is yielding a very small quantity of phosphate rock, about 875 tons, which is consumed locally for manufacturing fertilizers.

ARKANSAS.

Phosphate mining will be facilitated by better railroad transportation, and the Arkansas Phosphate Company is operating steadily at its Batesville acid phosphate plant. The most important deposits known are in north-central Arkansas, lying within parts of the counties of Independence, Stone, Izard, Searcy, Marion, Baxter and Newton. The rock is soft and easily crushed, and according to the State geologist, resembles the Tennessee phosphates. Two railroads are building; one leads up the White River from Batesville on the north side of the phosphate area, and the other is building southeast of Harrison through the south side of the locality.

GEORGIA.

A rather low-grade phosphate rock, light gray in color and from 3 to 4 feet deep, has been discovered in Walker, Catoosa and Cobb counties, but as yet no systematic mining has been begun.

TEXAS.

The Sabine Oil and Mineral Company has uncovered a deposit of phosphate on its oil land, some 80 miles north of Beaumont, but little attention has given the deposit, as the company is busy producing petroleum.

NEW MEXICO.

The guano beds of Lava, in Socorro County, are to be worked by the Los Angeles Chemical Company, which has been incorporated with a capital of \$20,000.

OTHER STATES.

In Missouri and Alabama a rather lean rock has been discovered, which does not warrant development yet.

IMPORTS.

Imports of Belgian and other phosphates into the United States in 1902 amounted to about 135,000 tons, valued at \$4.80 per ton, which compares with 174,462 tons, valued at \$4.98 in 1901. The bulk of these phosphates are used as "fillers" for fertilizers.

FOREIGN COUNTRIES.

New discoveries are reported, especially in Africa, while the rewards offered by the governments of New Zealand and South Australia are encouraging the exploration for phosphate deposits in those countries. Already good deposits have been uncovered in New Zealand, some 30 miles southwest of Dunedin, while others equally important may be reported at any time. In the older fields, especially in Algeria and Tunis, extensive work has been done during the year, while the production in the newer high-grade districts of Christmas Island and Ocean Island, operated by two English firms on long-time leases from the British Government is growing. Work has also been resumed on the Swan Island deposits in the Caribbean Sea, owned by an American. Unfortunately, the Marcus Island guano deposits, about 800 miles southeast of Yokohama, Japan, and 2,800 miles west of Honolulu, once claimed by an American, are now the property of Japan.

It is interesting to add that the Belgian superphosphate manufacturers have finally completed their combination. In Italy a similar organiza-

tion has been formed, which has facilities for producing more than 400,000 tons of superphosphate annually, and intends to regulate its output by the consumption and to fix prices accordingly. The Somme, France, superphosphate syndicate has been dissolved, initiating a general demoralization in prices. In Russia, the abolition of the export tax this year on phosphorites is expected to greatly benefit the phosphate mining industry which has lain dormant so long.

On the whole, the foreign phosphate industry showed a heavy production in the past year, but prices have not been good, owing to American competition. Algerian, 63 to 70 per cent rock, sold c. i. f. European or United Kingdom ports at an average of \$8.37 down to \$7.77 per ton; 58 to 63 per cent, at \$6.15 to \$6.75, then at \$6.57, and 53 to 58 per cent at \$5.64 to \$5.53. A large part of the Algerian output was contracted for in 1901 at low prices to be delivered in 1902 and 1903. The entire 1902 production of Tunis phosphates, amounting to about 250,000 tons and about 50,000 tons of that for 1903 was also taken in 1901 at reduced prices. Particular mention is made of these phosphates, because they are the most aggressive competitors of the American.

THE CHEMICAL AND ALLIED MINERAL TRADES IN 1902.

BY CHARLES C. SCHNATTERBECK.

In America rapid progress is being made in the manufacture of chemicals, notably those which have heretofore been considered entirely European products. To illustrate the growing importance of our chemical industry reference need only be made to the continued falling off in imports during the last few years. In some lines though our advance is slow, because experiments have not yet warranted the erection of new works. More capital, however, is being invested, and the time does not seem far distant when we shall equal if not excel certain European countries. And when we learn to save and utilize all our by-products of manufacture we may realize the profits that to-day place Germany at the head in the chemical industry. Meantime we can find encouragement in the fact that cheap electrical power is enabling us to greatly reduce the cost of production, and with skilled labor to manufacture chemicals of fine quality. We may also hope to be benefited by an increased domestic supply of raw material, which will free us from the dictation of foreign combinations.

Alkali.—The domestic production is growing steadily, and as prices are low and the quality of alkali good, imports have fallen over 60 per cent in two years. Consequently, competition is keen between importers and domestic makers, and prices on future business are lower to-day than in years. Last year, 1902, contracts for domestic high-test alkali were booked at 77½@82½c. per 100 lbs., f. o. b. works, while this year, 1903 and 1904, season orders have been taken at 72½@80c. Outside of these contracts business in 1902 has been done at 80@87½c. for prompt shipment, and 72½@85c. for forward deliveries, second hands being in control of the spot market. In foreign alkali contract deliveries were made this year at 85@87½c., f. o. b. New York, while transient trade was done at 90@92½c., the higher price being due to firmer ocean freight rates and smaller imports.

Caustic Soda.—Manufacturers of electrolytic caustic soda are proving hard competitors to sellers of the old process article. Imports are suffering severely from this competition. Contract deliveries for 1902 of domestic high-test caustic soda have been made at \$1.85@1.95 per 100 lbs., f. o. b., while 1903 and early 1904 business has been done at \$1.65@1.90, prices being according to seller and time of delivery, the lower range holding good for late 1904 shipment. These prices are among the lowest on record. Prompt

1902 trade was influenced by the variable stocks in makers' hands; prices fluctuated between \$1.85@\$2 per 100 pounds, f. o. b. works, the higher range ruling early in the year. At the close prompt shipments are quoted at \$1.90@\$1.95, and forward deliveries \$1.65@\$1.75. Foreign prices were nominal at \$2.25@\$2.75, f. o. b. New York, as to quantity and delivery, as importers made deliveries on renewal contracts chiefly.

Bicarb. Soda.—Trade has been good, and some exports are noted. Ordinary grades sold at 95c.@\$1.25 per 100 pounds, f. o. b. works, and extra, \$3@\$3.25, less usual discounts. Foreign has also been in good request, selling at \$1.37½@\$1.60, f. o. b. New York.

Sal Soda.—Domestic is a keen competitor of the foreign article. Demand, however, has been very good. Prices for domestic sal soda were 55@60c. per 100 pounds, f. o. b. works, and the foreign, 65@70c., f. o. b. New York. The market was particularly firm during the warm weather. At the close of the year prices are 55@60c. for domestic, and 67½c. for foreign. Imports into the United States in 1902 were 3,625,000 pounds, against 4,520,634 pounds in 1901; showing a decrease of 895,634 pounds.

Chlorate of Potash.—An increased domestic production, coupled with heavy imports, caused sharp competition, which resulted in establishing exceptionally low prices. In January forward contracts were booked at \$7½@\$7¾ per 100 pounds, f. o. b. works, for domestic, while prompt deliveries ruled at \$8@\$8¾, according to seller. In the last quarter of the year 1903 orders were taken at \$6½@\$7¼, while prompt shipments were made at \$7¼@\$7¾. The foreign article manifested greater weakness, owing to the unsettled condition of the European market. Prices on contract were \$7½@\$7¾ in New York early in the year, while spot was quoted at \$10@\$10¾, but transient sales were light. Later 1903 contracts were accepted at \$6¾@\$7¼, while immediate shipments were offered at \$7½@\$8. Deducting 2½ cents per pound duty, and the ocean freight, it will be seen that foreign chlorate of potash has been selling at prices that are among the lowest on record. Our imports were 1,210,000 pounds, against 811,107 pounds in 1901; showing an increase of 378,873 pounds.

Bleaching Powder.—The consumption is heavy, as is shown by the large imports and increased domestic production. Prices, however, have been very unsatisfactory, and exceptionally low figures are named for 1903 delivery, owing to the termination of the European trade agreement on December 31, 1902. In fact, the prices accepted on new contracts are so low that it is impossible for the older works to compete with the modern plants employing electrolytic processes. It is also noteworthy that the combination which has existed between the United Alkali Company and the Continental makers has been more advantageous to German and French works than it was to British producers. During the early excitement when the agreement was to be dissolved, some large orders for 1903 delivery were booked in Great Britain at £4 (\$20) a ton, less 2½ per cent delivered free at consumers' works. This price leaves only about £3 10s. (\$17.40) at the producers' works in Liverpool, and is very nearly the cost of manufacture. Later, however, makers' prices stiffened, though it was said no reasonable offer on renewal contracts would be refused. A similar condition prevailed in the Continental markets. In New York importers were perplexed by the competition, as they were often undersold by the American makers. The domestic consumption is now about 75,000 or 80,000 tons a year, of which our own works contribute an increasing quantity, while Great Britain and Germany furnish the bulk of the imports. In 1902 new contracts for 1903 delivery were booked in New York at \$1.80@\$1.20 for prime Liverpool, \$1.75@\$1.15 for Continental and \$1.62½@\$1.00 for domestic. Some 1904 contracts were taken in the closing

months of 1902 at \$1@\$1.25, according to test and seller, but large consumers were not anxious to book so far ahead, as they believe prices will go lower. The business in 1902 was principally at contract prices of \$1.75@\$1.90 for prime Liverpool, \$1.50@\$1.85 for Continental, and domestic \$1.15@\$1.70, according to test, quantity and seller. The wide difference in price was caused by increased competition as the year advanced, the lower figures being about the close of the market in 1902. The imports into the United States in 1902 were 50,000 long tons, against 52,459 tons in 1901. A feature in the trade was the appearance of the new electrolytic bleach made by the Solvay Process Company, of Belgium. It tests well, and is being delivered to regular customers at prime brand contract prices.

Chlorine Gas.—Until recently this has been a European product, which was handled in America by one firm who acted as selling agents. Now a metallurgical concern, which uses the chlorination process extensively, will erect a plant in the West to manufacture chlorine gas, having obtained permission from the German patentees. The product of these new works, however, will not be marketed, as the concern will use all it makes. In New York liquid chlorine gas is sold at 30 cents per pound. This is rather high, considering the weakness in the price of prime bleaching powder, which contains 35 per cent chlorine.

Copper Sulphate (Blue Vitriol).—This is one of the more important commercial chemicals, being a by-product in the refining of copper, and finding large use as an insecticide for plant life. The production in the past year has grown materially, while its sale, though small in European markets, shows a large increase in America. Market prices are somewhat lower than 1901, owing to the depression in copper, and in November and December, to the aggressive competition with importers of the British article. Heretofore the domestic production has been sold by comparatively few concerns, who fixed prices according to demand, and depended to a degree on the export trade. Now it appears outside makers and importers would create a new era of prices in the American market. The duty on imports is ½ cent per pound.

In January, prices f. o. b. New York, opened at \$4.50@\$4.75 per 100 pounds, according to quantity and seller, but before the close of the month quotations were down to \$4.12½@\$4.25. Weakness in the price of copper was responsible for this decline, though the pressure to sell outside makes of copper sulphate had also something to do with it. Exports from the United States in January were only 3,100,360 pounds, or fully 27 per cent less than last year. In February New York prices were \$4.25@\$4.50, and in March, when exports were only about half those of a year ago, quotations were \$4.37½@\$4.62½. April showed the effects of an improved domestic consumption by a strengthening in prices to \$4.50@\$4.62½. The exports from February to April, inclusive—usually the best season in the year—were only 21,127,797 pounds, or 12,112,446 pounds, 36.4 per cent, less than 1901.

In the following three months prices remained stationary at \$4.50@\$4.62½, though export trade continued to diminish. In August New York prices strengthened to \$4.60@\$4.70 in large lots, and \$5@\$5.25 in smaller quantities. In September and October prices ruled between \$4.50 and \$4.60, in large lots, and \$4.70@\$5 for less than car-loads. It is interesting to note that the exports from all United States ports during the 11 months ending November 30 amounted to 30,128,845 pounds, as against 47,345,391 pounds in the corresponding period in 1901; showing a decrease of 17,216,546 pounds, or 36.4 per cent, due chiefly to the smaller trade with Italy and Austria. The average invoice value of this year's exports was \$3.99 per 100 pounds, as compared with \$4.72 in 1901; showing a reduction of 73 cents this year.

In November and December foreign copper sulphate came into the market, selling at \$4@\$4.50 in a wholesale way, and forcing Americans to reduce their price to the same level.

Sulphuric Acid.—Probably no other commercial acid had such a large consumption in 1902 as sulphuric acid, notwithstanding periodical depressions in the industrial world. The principal consumers were the manufacturers of fertilizers, the textile and paper mills, metallurgical works, and the refiners of petroleum. Small quantities of sulphuric acid have also been exported, chiefly to Central and South America. Prices, with few exceptions, were firm throughout the year, owing to the high cost of raw material. The combination quoted wholesale prices, f. o. b. New York and vicinity, as follows, per 100 pounds in carboys: 60°, \$1@\$1.05; 66°, \$1.20. For bulk (in tank cars) quotations were: 50°, \$13.50@\$14 per ton; 60°, \$18; 66°, \$21. Smaller quantities commanded higher prices. Business for 1903 delivery has been done on basis of these prices, as makers usually take long-time contracts.

Nitric Acid.—Consumption has been larger in the metallurgical industry, and in the textile districts; but manufacturers of explosives have taken less, owing to the coal miners' strike. Combination prices ruled steady as follows, per 100 pounds in carboys, f. o. b. New York and vicinity: 36°, \$4; 38°, \$4.25; 40°, \$4.50; 42°, \$4.87½. It is customary to make season's deliveries on contracts taken the year previous, hence the spot market does not fluctuate.

Muriatic Acid.—Higher prices have been asked this year, as production is controlled by a few concerns. Deliveries on contract have been good. F. o. b. prices at New York, for large lots in carboys, were as follows, per 100 pounds; 18°, \$1.50; 20°, \$1.62½; 22°, \$1.75. New contracts for 1903 delivery have been booked on basis of these quotations.

Oxalic Acid.—Competition has been very keen since the dissolution of the European combination, and prices have been so low as to yield little profit to manufacturers. From January to early April much business was done between \$4.75 and \$5.25, the English acid selling at the higher prices. From the last two weeks in April to about the middle of September quotations were \$4.60@\$5 per 100 pounds in New York. Thereafter the market was much unsettled, fluctuating between \$4.50 and \$6.87½, the higher prices resulting from rumors that European manufacturers had settled their differences. During this period speculators were particularly active, and by the end of the year succeeded in forcing prices for 1903 delivery down to \$5.25 for German and \$5.50 for English brands. These prices, however, are somewhat better than those booked a year ago, when the demoralization in trade was first felt.

Carbon Dioxide.—Demand is growing, and production will be increased by the erection of new works in Los Angeles, Cal., and at Zeligonople, Pa., by recently incorporated companies. The annual output of the Zeligonople plant will be from 2,000,000 to 3,000,000 pounds, and coke will be the raw material used. In New York, where the production is extensive, Grecian magnesite is used, and the by-product, so-called, calcined magnesite, is sold for lining steel furnaces. The largest consumers of liquid carbonic acid gas are the manufacturers of artificial beverages. A new use is as power to regulate the signal system on steam roads. The acid gas is shipped in steel drums of 20 to 25 pounds capacity, and sells in New York at 12½ cents per pound.

Brimstone.—Consumption in the United States has been increased by the heavier demand from the sulphite pulp mills. It is estimated that our annual imports of crude brimstone now amount to about 36 per cent of the total exports from Sicily. This fact is worthy of note, as the demand for brimstone in the fertilizer acid trade which has heretofore been an important con-

sumer, is gradually being satisfied by pyrites, which yield sulphur at a comparatively lower cost. Attempts are also being made to use pyrites in the manufacture of sulphite pulp, and in time we may see a change in this direction. High prices, initiated by the Silician combination are responsible for this transition. To show the prestige of the combination it may be mentioned that it controls over 85 per cent of the brimstone production, and having unlimited capital to carry large stocks, can dictate terms to the dissidents who are obliged to sell to speculators. Owing to smaller exports this year, however, the Anglo-Silician Sulphur Company shows a decrease in earnings. In the first year of the new agreement, being the sixth financial year, ending July 31, 1902, the company reported net profits of £89,378 (\$446,390), which are 19.4 per cent less than the previous year. The usual 6 per cent dividend has been paid on the outstanding preferred stock, while £20,499 (\$102,495) has been added to the reserve, against any eventual depreciation of stocks of sulphur, making that account £57,029 (\$285,145). The general reserve fund on July 31, 1902, stood at £121,982 (\$609,910). Since then the last installment has been called on its shares, making the paid-up capital £1,035,000 (\$5,175,000). The combination has 5 years longer to run.

Prices in 1902 show an increase over the previous year, owing to the refusal of the syndicate to make concessions unless for very large quantities, and the firmer freight market. Below we give the average monthly shipment prices of best unmixed seconds, and best thirds per long ton, f. o. b. Sicily and in New York. We also give the freight rate to the United States, to show its influence on New York prices for brimstone:

Month.	New York.		U. S.	Sicily.	
	Best 2ds.	Best 3rds.	Incoming Freight.	Best 2ds.	Best 3rds.
January	\$23.38	\$20.88	\$2.04	\$20.40	\$17.04
February	23.13	20.63	1.98	20.34	17.82
March	22.84	20.34	1.98	20.16	17.88
April	22.53	20.03	1.74	20.10	17.94
May	22.44	19.94	1.74	20.04	18.12
June	22.40	19.90	1.71	19.74	18.12
July	22.15	20.15	1.80	19.44	17.76
August	22.20	20.20	1.86	19.80	18.00
September	22.50	21.00	2.10	19.86	18.24
October	22.93	21.18	2.88	19.80	18.48
November	23.03	21.28	2.10	19.80	18.48
December	22.88	21.13	2.10	19.80	18.48
Year	\$22.70	\$20.55	\$2.00	\$19.94	\$18.03
1901	21.93	19.60	1.77	19.37	16.51
Increase 1902..	\$0.77	\$0.95	\$0.23	\$0.57	\$1.52

In considering the above schedule it is interesting to note that the earnings of importers at New York during the past year have been rather small, as the bulk of arrivals is delivered on time contracts and little is sold at the higher spot prices. It is also noteworthy that the difference between the prices for shipments and spot has been less this year than 1901, although a few store parcels sold at a very high figure. The average monthly prices of spot brimstone was highest in February, when the market felt the scarcity from light imports. Up to \$28 was quoted ex-store for best unmixed seconds, and \$25.50 for best thirds, while the average for the month was \$24.47 and \$21.97, respectively. The lowest prices ruled in June, when best unmixed seconds sold in New York down to \$23, and best thirds at \$20.50, making a monthly average of \$23.03 and \$20.53, respectively. In the first six months of the year the United States imports were 89,914 long tons, or fully 25 per cent larger than the corresponding period in 1901. Consequently New York spot prices weakened in the last half of the year, though there was no demoralization, owing to the firmness in the primary market. The average price of spot brimstone in 1902 was \$23.54 for best unmixed seconds, and \$21.65 for best thirds. Compared with 1901 these prices show an increase of 59 cents per ton for best unmixed seconds, and 95 cents for best thirds.

The exports of brimstone from Sicily in 1902 were approximately 453,000 tons, as against 462,-

299 tons in 1901; showing a decrease of over 9,000 tons. Of the shipments in 1902 about 163,000 tons were destined to the United States, which compares with 144,817 tons in 1901; showing an increase of about 19,000 tons. Stocks in Sicily, though still very large, are somewhat smaller at the end of the year, being about 258,000 tons, as against 310,123 tons on January 1, 1902, and 289,785 tons on December 1, 1901. Production, on the other hand, is estimated at 498,000 tons, or nearly 50,000 tons less than 1901, but it is believed to have been larger, as there are said to be stocks not accounted for by the combination in their public announcements.

In September a small lot of Venezuelan sulphur arrived at New York, being the first shipment from the mines of the German company operating near Carupano. During the year the Mexican sulphur deposits were opened, and preparations made to ship to the United States. The Virginia-Carolina Chemical Company, the Southern fertilizer combination, owns Mexican sulphur property, which it will develop with a view to getting an independent supply of this raw material. The American production of sulphur is still rather small. A discovery has been reported from Tunis, in North Africa, and should it be developed the sulphur will probably be consumed locally.

Pyrites.—The high price of brimstone has caused increased consumption of pyrites, the largest buyers having been the fertilizer manufacturers. Domestic production and imports show an improvement over 1901, while prices continued firm and satisfactory to sellers, who have made long time contracts. Considerable new work has been done in Southern pyrites mines, and it is noteworthy that the Virginia-Carolina Chemical Company has purchased additional property in Georgia to assure it an independent supply of pyrites. In Alabama more capital has been invested in the Clay County deposits, where Swift & Co., the Chicago meat packers, have much land and after mining for some months have fully 175,000 tons of pyrites ready for shipment. This quantity will be moved when the branch railroad now building by the Louisville & Nashville Railroad is completed. In Virginia active work has been prosecuted, and the output has increased. In the import trade a feature has been the new departure made by the Rio Tinto Company of Spain, in appointing a regular representative for the United States and Canada, instead of selling through agents. Interest was aroused by a resumption of shipments from Pilley's Island, Newfoundland, and by the importation in January of 1,450 tons copper pyrites from Norway for the Orford Copper Co. The total imports of pyrites, chiefly from Spain, in 1902 amounted to about 410,500 long tons, which compares with 398,969 tons in 1901; showing an increase of 11,531 tons, or 3 per cent. The sulphur contents of the imports in 1902 were equivalent to 197,040 tons, as against 187,515 tons in 1901. The value of imported pyrites fluctuated between 12 and 13½ cents in 1902, being based on a sulphur content of 46 to 51 per cent. Most of the imports were of iron pyrites containing 40 per cent iron, while the copper ore received carried a little over 2 per cent copper on the average. In both instances the metal yielded some profit, as it was recovered and sold to consumers at current prices. In this connection it should be chronicled that the extensive works of the American Copper Extraction Company, at Garwood, N. J., was destroyed by fire in the spring. The plant was owned by the Davis Sulphur Ore Company, a large importer of Spanish pyrites.

Ocean freight rates, which have an important bearing on imports, were strong in 1902, owing to the fact that less return freight has been offered by America. Pyrites are invariably shipped as ballast, and so have the benefit of a lower rate than other merchandise. The extreme freight rates from Huelva, Spain to Atlantic ports were

9s. (\$2.16) per ton in August, and 11s. (\$2.64) in December. In the other months of the year charters were booked at 9s. 3d. (\$2.22) to 10s. 6d. (\$2.52), and it was common to hire entire steamers for the voyage. Domestic pyrites, of which the production in 1902 was not far from 304,000 long tons, sold at \$5 per ton for lump ore, and 10 cents per unit for fines, f. o. b. Mineral City, Va., or Charlemont, Mass. The American pyrites carry from 42 to 44 per cent sulphur on an average, though a higher grade ore has been marketed. Prospects for 1903 are good both for production and consumption, while prices are expected to show little fluctuation.

Alum and Sulphate of Alumina.—Production is expected to grow with the erection of the proposed new works in Ohio. At present the output is largely controlled by the Pennsylvania Salt Manufacturing Company and the General Chemical Company, who fix prices when the season's contracts are made. New York quotations for alum in wholesale lots are \$1.75 per 100 pounds for lump, \$1.80 for ground and \$3 for powdered. Commercial sulphate of alumina is worth \$1.15@1.25 per 100 pounds, and purer grades \$1.50@2. Consumption has been larger than 1901.

Copperas (Ferric Sulphate).—Consumption in 1902 has been phenomenal, the demand exceeding the supply for the first time in years. Nevertheless, competition among makers has been keen, forcing New York bulk prices down to 20 cents per 100 pounds in October, at which those outside the combination made sales. In January the price for bulk was 30 cents, and in July, when stocks in makers' hands were small, 37½ cents. The latter price was held by the combination at the close of the year. In barrels, 5 cents more was asked. Uses for copperas are many, in the manufacture of pigments, as an ingredient in a paste for polishing glass, and as a water purifier.

Cyanide.—Owing to the heavy production in Europe, which caused an accumulation of stocks while the Transvaal war was on, the market price of potassium cyanide has ruled low in 1902. Opening in January at 24 cents per pound, for large lots, f. o. b. New York, it soon weakened to 23 cents, and it is believed contracts have been made at less. The latest price quoted at producing centers abroad is equivalent to about 19 cents, f. o. b. shipping port. The import duty here is 12½ per cent ad valorem. At the close of the year importers continue to quote 23 cents. Prospects for the new year are brighter, as the South African gold mines are again actively at work.

Cryolite.—Consumption is about one-half what it was six years ago; but prices are fractionally better at 6½ cents per pound, f. o. b. New York. Imports into the United States from Ivigtut, Greenland, are at the rate of 5,000 to 6,000 long tons annually, which is consumed principally in the manufacture of aluminum and sodium salts. A small quantity is also used in the production of hydrofluoric acid, and in the manufacture of opalescent glass.

Bromine.—Competition has been aggressive since the Dickey and Patrick plants at Midland, Mich., have passed into the hands of one of the largest consumers—the Meyer Brothers' Drug Company, of St. Louis, Mo. This concern will not operate these plants until the spring, but has contracted with the Dow Chemical Company, of Midland, Mich., for its supply of bromides in the meantime. Very low prices are understood to have been taken on long time contracts by concerns affiliated to the late combination, although the quotation in New York holds at 40 cents per pound.

Barytes.—Few important barytes mines in this country are not now in the St. Louis combination, which fixes prices and divides markets with its constituents. Nevertheless, importers are doing a fair business, as they do not hesitate to renew contracts with old customers at advantageous terms. On the other hand, mining has been ex-

travagant, more than equaling the consumption, and stocks have fast accumulated, but prices continue as follows, f. o. b. New York: American crude No. 1, \$9 per short ton; No. 2, \$8; No. 3, \$7.75; German gray, \$14.50; snow white, \$17. Barium sulphate (blanc fixe) was quoted at 2 cents per pound.

Arsenic.—Freer offerings by importers had a weakening effect on prices, notwithstanding the heavy consumption by glass makers and others. There are now four foreign makes of white arsenic on the market—English, German, Canadian and Spanish. The Spanish article is a new arrival, and is guaranteed to contain 99.80 per cent arsenious acid. The British production has been curtailed by the closing down of the Devon Great Consols Mine in England, while in Germany some of the older properties are also yielding less. The American production, however, is increasing, and contracts for 1903 delivery have been closed around 2¾ cents per pound, f. o. b. New York. Foreign sold at 3@4 cents for spot delivery, and 2¼@3 cents for 1903 shipment. Red arsenic, imported from Germany, was also weak, and sold at 6½@7 cents per pound, f. o. b. New York.

Zinc Dust.—Quite a quantity is being used in the cyanide process for precipitating gold. Our own production of zinc dust, though fairly large, does not satisfy the demand, so we import from Belgium and Germany. The tariff was taken off in May, this year, after much discussion, and now the article is on the free list. Foreign zinc dust, said to be almost free from lead, is now selling in New York at 4½@5 cents per pound, while earlier in the year quotations were 5½@5¾ cents.

Chrome Ore and the Bichromates.—Trade has been good, and prices satisfactory to the few who control supplies and make deliveries on long time contracts. The bulk of the chrome ore sold has come from Turkey, as the domestic production is insignificant. This ore has been used for lining blast furnaces and converters, for manufacturing steel and alloys, and in the chemical industry. Market prices, ex-ship New York, ranged from \$21 to \$24.75 per long ton for 50 per cent ore, though larger quantities of lower grade material have been sold. Chrome bricks, made in Pittsburg, Pa., and abroad, have sold at \$175 per thousand, and are used for furnace lining. Bichromate of soda brought 6½@6¾ cents per pound, and bichromate of potash, 8½@8¾ cents for American, and 8½@9 cents for Scotch, f. o. b. New York. The feature of the trade was the sale of the Baltimore Chrome Works, of Baltimore, Md., to the Kalioa Chemical Company, of Philadelphia, for \$1,000,000. The Baltimore works supplies the bulk of the dyeing and tanning material consumed in this country.

Nitrate of Soda.—Speaking from a financial standpoint the year 1902 has been a very successful one, market prices have been high, and the profits of the oficinas have warranted the payment of substantial dividends to stockholders. There have, however, been some trade difficulties, such as the anthracite coal miners' strike in Pennsylvania, and the depression in the beet sugar industry of Europe, which have curtailed consumption. High prices have also helped to lessen the demand. The world's consumption is estimated at about 29,195,200 quintals, or, say, 1,319,742 long tons, which compared with 1901 shows a falling off of fully 44,000 tons. The production in 1902 was approximately 30,291,500 quintals, or 1,373,936 tons, as against 31,258,687 quintals, or 1,417,806 tons in the previous year; showing a decrease of 967,187 quintals, or 43,870 tons. Exports from Chile, which are regulated by the combination, according to the previous year's consumption, totaled 29,775,000 quintals, or 1,350,509 long tons, which compares with 27,386,112 quintals, or 1,242,156 tons in 1901; showing an increase of 2,388,888 quintals, or 108,353 tons in 1902. Considering the smaller consumption in the past year stocks have accumulated at distributing points, and on December 31, 1902, Chile

showed at least 645,000 tons. It is noteworthy that the combination, anticipating a further reduction in consumption, has fixed the exports for its second year (from April 1, 1902, to March 31, 1903) at 30,500,000 quintals (1,383,393 tons), or 773,000 quintals (35,061 tons) less than the first year (April 1, 1901, to March 31, 1902). The combination has until April, 1905, to run, and though it has been successful in the past it is impossible to predict what will happen in the future, as the high prices have not only curtailed consumption, but have favored the opening of new works and rehabilitated old oficinas. Moreover, the Chilean combination may be disconcerted by the working of the nitrate deposits in the Death Valley District of California, where much capital is being invested in land by people who have faith in a prosperous future.

Briefly, the California deposits are found in Bernardino and Inyo counties, and judging from analyses of the strata, are richer than the Chilean beds. Some specimens of the Death Valley niter analyzed from 15 to 40 per cent, and it is said about 22,000,000 tons are in sight. Fully 35,000 acres have already been located.

In Chile there were early in the year important labor troubles, or "lock outs," as some say, at Iquique and Caleta Buena, two leading shipping ports, which caused a scarcity of nitrate of soda at consuming markets, and sent prices upward. Later, when the strikes were adjusted, exports were rushed, but as there were more vessels than cargoes, ocean freight rates fell until they touched the lowest in some time. One charter was booked in November at 12s. 6d. (\$3), while in January the rates were 20s. to 21s. 3d. (\$4.80 @ \$5.10); but the bulk of the chartering has been done around 17s. 6d. (\$4.20). At one time the Chilean Government argued for an increase in the export tax from 2s. 4d. (56 cents) per quintal to 2s. 10d. (68 cents), but finally decided to leave the tax at 2s. 4d. as heretofore. This tax yields a large revenue to the government, and in the past year amounted to \$16,674,000, which compares with \$15,336,223 in 1901; showing an increase of \$1,337,777 in 1902. A reform instituted by the Government February 18, and one which will benefit the industry, was that nitrate duties shall be paid 90 per cent in bills and 10 per cent in gold, instead of 65 per cent in bills and 35 per cent in gold, as heretofore. The government has also prompted a uniform weight of bags used in shipping; namely, 100 kilograms (220 pounds avoirdupois), to be adopted from January 1, 1903. At present shipments are made in bags that weigh from 224 pounds to 336 pounds, the larger size going chiefly to the European market. An important feature of the industry has been the high range of prices obtained by the oficinas. Ordinary 95 per cent nitrate of soda sold in January at 6s. 8½@6s. 10d. per quintal (\$1.61@1.64) for prompt delivery, and 6s. 6½d.@6s. 8½d. (\$1.58 @ \$1.61) for futures, which were the highest prices in 1902. The lowest prices for this grade were obtained in July, 6s. 1½d.@6s. 4½d. (\$1.47 @ \$1.53) for prompt, and 5s. 11d.@6s. 4½d. (\$1.42 @ \$1.53) for futures. Refined, or 96 per cent quality, brought in January 6s. 11½d.@7s. (\$1.67 @ \$1.68) for prompt shipment, and 6s. 8d.@6s. 11d. (\$1.60@1.66) for futures. The lowest prices were quoted in July, 6s.@6s. 4½d. (\$1.44@1.53) for prompt, and 6s.@6s. 1½d. (\$1.44@1.47) for futures. All these prices are f. o. b. shipping ports in Chile.

It is interesting to note the profits of the larger oficinas by quoting from the annual report of the Lagunas Syndicate, which covers the year ending June 30, 1902. In this period the Syndicate realized a gross profit of £144,407 9s. 5d. (\$722,037) on 1,208,367 quintals of nitrate of soda, whereas in the previous year it profited £157,880 9s. (\$789,402) on 2,021,000 quintals. In other words, with 60 per cent of the previous year's output the Syndicate made 90 per cent of that year's profits. The profit per quintal this year is 50 per cent

larger than last year. It may be mentioned that the production and sales of the Syndicate from its first development to June 30, 1902, amounted to no less than 11,627,000 quintals of nitrate, and that, with the dividend of 10 per cent paid in the past year, there has been returned 32 per cent, or £360,000 (\$1,800,000) on the capital stock, besides a large part of the income has been amortised on the debenture account. Three smaller capitalized oficinas—the Santa Catalina, Santiago and Liverpool—have paid in the year ending June 30, 1902, dividends of 20, 18 and 17½ per cent, respectively.

A feature that attracted attention early in the year was the report that the Agricultural Co-operative Society of the Duchy of Hesse, Germany, an important consumer, had decided to purchase land in Chile to assure it an independent supply of nitrate of soda. In fact, a representative of that association was sent to Chile to select the property, but when opposition arose the scheme apparently fell through, and nothing has since been heard of it.

Europe is the largest consumer of nitrate of soda, and this year has delivered to distributing points in Great Britain and the Continent fully 1,028,910 long tons. This quantity, however, is 133,360 tons less than 1901, the cause being high prices and a demoralization in the beet sugar industry of Germany.

In referring to speculation in the trade it is interesting to add that the failure of C. Wehrhahn & Co., of Valparaiso and Hamburg early in the year threw something over 100,000 tons of nitrate of soda on the market, causing a depression in prices which would have become totally demoralized had not a syndicate been formed to dispose of this quantity. During the excitement the Hamburg market fell fully \$9.75 per ton, the spot price being equivalent to \$41.17 per ton. The largest amount of business done in Europe this year was in March when imports aggregated 190,410 tons, and deliveries for the same month were 127,640 tons. Spot prices at Liverpool, England, were then £10 10s.@£10 15s. (\$52.40@ \$53.60), less 2½ per cent for double bags, as per quality. The deliveries reported were 55,140 tons, while imports were 58,476 tons. Prices in Liverpool suffered a decline in that month, being £8 12s. 6d.@£9 (\$43@45), which is an average loss of \$9 in six months. The smallest deliveries were made in October, 33,930 tons; but prices were not affected.

Prices at other points, notably on the Continent, have fluctuated correspondingly, and it is understood that sellers have been anxious to book future deliveries at less.

In the United States the principal consumers are the manufacturers of gun and blasting powder, taking from 55 to 60 per cent of the imports of nitrate of soda. During the anthracite coal miners' strike the powder people suffered severely, as the demand for their goods from this source fell off entirely. On the other hand, however, the total deliveries of nitrate of soda from Atlantic ports do not show the effects of the coal strike, the reason being that powder manufacturers have accumulated stocks anticipating larger business when the labor troubles would be adjusted. The deliveries from Atlantic ports in 1902 are estimated at 1,382,000 bags, or, say, about 172,750 tons, as against 1,308,820 bags, or 163,602 tons in 1901, showing an increase of 73,180 bags, or 9,148 tons. It should be mentioned here that there were stocks on hand at the various ports on January 1, 1902, aggregating 77,517 bags, or 9,689 tons. The imports into the United States in 1902 were approximately 212,137 tons, as against 208,679 tons in the previous year; showing an increase of 3,458 tons.

It is noteworthy that our American farmers are slow to recognize the value of nitrate of soda as a fertilizer material. To enlighten them an attempt is being made at a systematic propaganda, as is being done in Europe, by distributing an-

alytical literature setting forth the advantages to be derived from using nitrate of soda for feeding and enriching soils.

The market price at New York has at times been less than the cost of importing, because importers held long time contracts at rather low prices. As these "sour" contracts were filled, importers became more hopeful, and held firmly for higher prices, anticipating a scarcity of supplies in consuming markets, owing to the labor troubles in Chile and curtailment of production by the combination. Speculators, however, were not asleep, and frequently when the spot market was bare of stocks, put in their hand and sent prices upwards. As speculators did business mostly on a small scale, a better criterion of prices would be the range quoted by importers. In January spot opened at \$1.95@1.97½ per 100 pounds, f. o. b. New York, while futures were held at \$1.95. At the end of the month prices were elevated to \$2.10 for spot and \$2 for futures, and in February a further advance was made to \$2.25 for the former, and \$2.05 for the latter deliveries. This was about the time that the labor troubles in Chile began to exert themselves most forcibly by restricting shipments. In April spot touched \$2.40, and futures \$2.05 upward, according to position, while retail sales ex-store were made at \$2.75. In May prices eased off somewhat, spot selling down to \$2.10 and futures \$1.92½. Arrivals were frequent about this time, relieving the pressure for supplies. From now on until the end of the year prices became lower. The highest monthly average was in April, \$2.38 for spot, and \$2.14 for futures; while the lowest was in August, \$1.87 for spot and \$1.85 for futures. The year closes at \$1.97½ for spot and \$1.85 for futures. On the whole, prices show a marked improvement over 1901.

An interesting item in the shipping trade, besides the low ocean freight market, was the launching of the new steamer *Virginia*, which landed 54,000 bags in Philadelphia, this being the largest single cargo of nitrate of soda ever imported into the United States. W. R. Grace & Co., the well known steamship and importing firm, are the owners. Two steamers, the *Lady Joicy* and *Hero*, carrying 26,000 bags and 42,000 bags, respectively, were wrecked in June, their owners being W. R. Grace & Co., and Brown, Beeche & Co.

Sulphate of Ammonia.—Gas liquor has been in good request, and owing to smaller shipments from Great Britain to this country, prices have advanced. True, domestic production is growing, but it is not yet large enough to meet the consumption. In January foreign gas liquor (24@25 per cent) opened at \$2.82½@2.85 per 100 pounds, f. o. b. New York, for forward shipment, while the domestic was quoted at \$2.75@2.80. Spot was nominal. In later months the market strengthened materially, and by June arrivals were quoted up to \$3.17½ for foreign. In July, however, prices were softened by the withdrawal of speculation, and quotations were \$2.95@3 for shipments, and \$3.02½@3.10 for spot. In early December shipments were quoted \$3@3.02½, and spot \$3.05. The average price for the year was \$3 for spot, and \$2.97 for shipments, showing quite an increase over 1901.

Potash Salts.—The most important feature in 1902 was the "community of interest" agreement between the German Kali Syndicate and the Virginia-Carolina Company, the big Southern fertilizer combination. This agreement was not signed, however, until the Virginia-Carolina Company had optioned valuable independent potash property in Germany, and thereby threatening to produce its own supplies. Fear of losing such an important consumer the Kali Syndicate was forced to arbitrate, and now both the Virginia-Carolina Company and the Agricultural Chemical Company, the latter being known as the Northern fertilizer combination, will receive an ample supply of potash salts at advantageous

prices. As these two concerns are the largest consumers in America no change has been made in the published schedule of prices from 1901. Imports into the United States in 1902 have fallen off somewhat, as consumers held rather heavy stocks on January 1. The industry in Germany is passing through a period of depression, production exceeding the demand, while the active development of new independent properties has weakened prices. It is noteworthy that much attention is being devoted to deep mining, as borings down to 3,250 feet have shown an excellent quality of potash. Sinking deep shafts, however, is costly, and already considerable money has been spent on this work without meeting success. The cardinal trouble is that at about 1,000 feet the flow of water becomes very heavy, and companies who have mined to this depth have suffered severe loss. Explorations for new ground are being diligently prosecuted by boring companies, and in numerous instances have shown good results.

THE NEW YORK MINING STOCK MARKET IN 1902.

By CHARLES C. SCHNATTERBECK.

The year just closed has been an exciting one for the stock market, as the bear speculators have been much in evidence, depressing prices and causing liquidation. The low metal market, especially for copper and silver, coupled with a stringency in the money market, undoubtedly helped the operators in their raids. In short, mining shares have sold generally below last year's average. The sales in 1902 aggregated 8,575,029 shares, which compares with 12,063,196 shares in 1901. We will confine our remarks to stocks that are dealt in on 'change and have a market value.

The copper shares have attracted widespread attention. Amalgamated has had a checkered career, being worried by lawsuits, an unsettled copper market and professional manipulation. Moreover, the cut in the original dividend rate of 8 per cent per annum to 2 per cent had a demoralizing effect on the stock market, and caused prominent liquidation. On February 1 the stock brought \$79, which, though it is the highest point this year, is 51 points lower than the top notch in June, 1901, when \$130 was recorded. At times the stock fluctuated as much as 8½ points in one month, but later when insiders gave their support the margin narrowed down to 2¾ points. On November 14 the stock dropped to \$53, the lowest price on record. Thus in 10 months the market value of Amalgamated lost over \$40,000,000. In early December insiders again appeared on the market, and assisted by rumors of a trade agreement beneficial to the company, the stock advanced to \$58¾. But this advance was not maintained as the rumors were denied, and the price fell to \$54. Thus the year closes weak.

Anaconda, a subsidiary company in the Amalgamated consolidation, has also reduced its original dividend rate from 16 per cent annually to 4 per cent, which sent the price of the shares below par. The highest price in 1902 was \$36.50 on February 1, and the lowest \$20 on December 12, showing a loss of over \$19,000,000. Sales, however, have not been large.

On curb the coppers have been influenced by trading in Amalgamated on 'change. A feature was the appearance early in May of the United Copper Company, the \$80,000,000 consolidation of the Heinze properties in Montana. United was incorporated in New Jersey on April 28, 1902, with \$5,000,000 in 6 per cent preferred stock (held by insiders), and \$75,000,000 common (\$45,000,000 issued). Among the important holdings is the Montana Ore Purchasing Company, which has paid in dividends more than its total capitalization. The initial sales of United common shares were made at \$36 to \$35¼ when issued. This is 32½ points less than was being paid for Amalgamated, whose capital is \$75,000,000 great-

er than United's. Later in May United brought \$34½ to \$36¾, the latter price being the highest on record. In July the stock was listed on the Boston Exchange, while on the New York curb it sold at \$35½. In September the price weakened to \$29, and recovered to \$31½ in October. In November the first 3 per cent dividend was paid on the preferred stock. This strengthened the common stock to \$33½, but later it dropped to \$27, the lowest on record. In December sales were made around \$28. Transactions were small. Greene Consolidated, of Mexico, has had its supporters who sent the price of the \$10 shares to \$31.38 in May. Two months later, however, there was a reaction to \$19.50. On November 5 the company increased its capital stock from \$6,000,000 to \$7,200,000, the additional \$1,200,000 being issued to liquidate the indebtedness. Stockholders received one new share for 5 old at \$20 per share, the price at which the entire issue had been underwritten without commission. Prior to the increase the old shares sold at \$21¾ to \$22, ex-rights, while the rights brought \$100@34 per 100. Immediately after the increase in capital was ratified by the stockholders, the new shares sold at \$24 to \$22¾, and rights changed hands at \$76@50 per 100. A few weeks later a dividend of 2 per cent was declared, payable in January, 1903. In December the stock stood at \$25. Tennessee, which is closely controlled, was one of the few stocks that advanced near the close of the year. It rose from \$10¾ in April to \$19¾ in October, and in December large sales were made around \$18. These prices, however, are lower than 1901. White Knob, of Idaho, has been engineered by insiders, who elevated the price to \$27.25 in April, but in October were forced to let loose at \$10. Sales were small, and the year closes around \$11, which compares with \$15 paid in January by a syndicate for 25,000 shares. British Columbia has been erratic, owing to inside manipulation. In January the price opened at \$10, dropping to \$8½ in February, and recovered to \$10½ in March, the highest price this year. This, however, is considerably lower than 1901. In September the market weakened to \$4¾, the low record, and after rising to \$7 in November, closes the year around \$5½. Montreal & Boston, also of British Columbia, a new company capitalized at \$3,000,000, with property in the Osoyoos Division of Yale District, came on curb in January. Its \$5 shares sold at \$3.25@4, the latter price being the highest this year. In April the market softened to \$2¾, and in June a large business was done at \$2@2¾ on information that the new smelter had blown in. In August the price advanced to \$3¾, but in November it again fell to \$2¾. Reports published in early December that the property was to go in a smelter combination in British Columbia, and that English people had secured a large block of the stock, sent the price to \$3¾.

There were also called on curb for the first time in August the shares of the Bamberger-De Lamar Gold Mines Company, a \$5,000,000 consolidation of Capt. De La Mar's properties in Lincoln County, Nevada. The subscription price was par \$10 for 150,000 shares, but curb sales were made as high as \$11 and as low as \$9½. Empire Consolidated Quicksilver, of California, was offered in July at \$1½@1¾ for the preferred stock, but little has been done in it. The company was originally capitalized at \$5,000,000, and after paying one dividend of \$15,000,000 was dissension in the management, and the company was reorganized on a \$2,000,000 basis.

On 'change the gold and silver shares have been unsteady, being influenced by lower prices for the commercial metals, and smaller dividends by some of the regular payers.

Ontario Silver, of Utah, though paying quarterly dividends of 30 cents each, fell from \$9.50 to \$5.50 in 10 months, which is the lowest price in years. Horn Silver sold mostly around \$1.50, though it opened at \$2@1.30 in January, which were the

high and low points this year. An odd lot of Daly brought \$1.50@\$.1.60. Homestake Gold, of South Dakota, owned in New York and San Francisco, has suffered a decline from \$99 on February 7 to \$65 on November

000,000 to \$22,000,000 to pay for property purchased and improvements made. Of this increase 8,400 shares (par \$100) were offered stockholders in the proportion of 4 per cent of their holdings at \$75 per share. The balance of \$160,-

upon which it had paid \$1,350,000, or 27 per cent, in dividends. In the Colorado list the Cripple Creek stocks were most in evidence, and were influenced unfavorably by the water question and the suspen-

FLUCTUATIONS OF MINING STOCKS IN NEW YORK DURING 1902

Name and Location of Company	Par Value	January		February		March		April		May		June		July		August		September		October		November		December		Sales
		H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	
Acacia, Colo.	\$1	28	14	14	14	45	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	8,500	
Adams, E. Colo.	10	15	15	15	15	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	278	
Alamo, E. Colo.	1	15	15	15	15	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	29,000	
Alice, E. Mont.	25	50	50	50	50	70.50	70.50	70.50	70.50	70.50	70.50	70.50	70.50	70.50	70.50	70.50	70.50	70.50	70.50	70.50	70.50	70.50	70.50	70.50	1,000	
Annamigatit c. Mont.	100	78.00	67.63	67.63	67.63	61.00	61.00	61.00	61.00	61.00	61.00	61.00	61.00	61.00	61.00	61.00	61.00	61.00	61.00	61.00	61.00	61.00	61.00	61.00	6,844,824	
Anascondita c. Mont.	25	35.50	29.25	29.25	29.25	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	27,403	
Anascondita c. Colo.	5	28	24	24	24	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	18,850	
Argon-Juni g. n. l. Col.	2	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	32,200	
Bachet, Nev.	3	14	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	2,800	
Best Abiecher g. n. Nev.	3	15	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	2,800	
Brunswick, Colo.	25	75	65	65	65	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	88,400	
Catalpa, E. Colo.	1	15	12	12	12	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	21,950	
Chrysolite, E. Colo.	1	15	12	12	12	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	88,400	
Conn. Tunnel, E. Colo.	50	12	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10,455	
Conn. Tunnel Bonds	2	07	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	173,500	
Conn. Tunnel Va. g. Nev.	100	07	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	173,500	
Cr. & Crip. Ch. g. Col.	2 1/2	1.80	1.15	1.15	1.15	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	44,310	
Cres. n. l. Colo.	10	11	07	07	07	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	23,200	
Cripple, Ch. Con. E. Colo.	1	11	07	07	07	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	1,400	
Grossus, Colo.	1	12	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	65,500	
Gr. Point g. n. Nev.	3	12	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	2,600	
Daly g. Utah	20	11	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	125	
Deadwood-Terra g. s. Dak.	100	11	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	5,200	
Dunkin, E. Colo.	1	1.33	1.12	1.12	1.12	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	41,000	
Elkton, Colo.	1	1.09	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	1,000	
El Paso, Colo.	1	1.09	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	32,600	
Golden Dollar g. Colo.	1	1.09	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	23,400	
Golden Fleece g. Colo.	1	1.09	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	23,400	
Greene Con. Mex.	10	26.75	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	324,464	
Hale & Norc. g. Nev.	3	34	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	13,500	
Hart g. Colo.	1	1.00	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	1,000	
Homestake E. S. Dak.	100	2.00	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	7,850	
Horn Hill, E. Utah	25	65	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	9,850	
Iron Hill, E. Colo.	20	33	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	9,850
Jack Pot, Colo.	1	35	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	97,770
Justice, E. Nev.	1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	14,000
Kings & Perm. l. Ont.	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	2,200
Lacrosse g. Colo.	10	07	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	3,850
Lead, Con. E. Colo.	10	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	600
Little Chief, E. Colo.	10	11	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	8,050
Mexican g. n. Nev.	3	45	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	13,400
Mine Securities, U. S.	100	18	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	7,500
Mollie Yibson s. Colo.	5	18	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	21,150
Moon-Anchor g. Colo.	5	27	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	68,280
Monitron g. Mont.	25	27	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	11,000
Occidental, Nev.	1	100	9.50	7.88	7.88	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	100
Ophir E. n. Nev.	3	92	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	800
Phoenix Con. g. Ariz.	1	07	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	06	12,004
Portland g. Colo.	10	2.75	2.50	2.50	2.50	2.45</																				

passed two quarterly dividends and cut the October rate in half, its shares falling from \$3.85 in May to \$1.25. The dividend of 9 cents per share in 1902 is the smallest disbursement in six years. This is explained by the heavy ex-

per share in April, which is the smallest year's disbursement since 1899. In January the shares stood at \$1.33, but in October 31 cents was quoted. Isabella, one of the most speculative stocks in the group, has also discontinued dividends. The

mine closed down in August, as all the available pay ore has been exhausted, and further explorations have not proved successful. In January the stock sold at 18 cents, and in December 6 cents is quoted. Argentum-Juniata, which has been worked jointly with Mollie Gibson, is also shut down, causing a drop in stock values from 15 to 2 cents. Breece, of Leadville, a moderate dividend payer, displayed the weakness in the silver market by receding from 75 to 30 cents. Iron Silver attracted attention early in the year, when the stockholders were asked to ratify the proposition to sell the company's property to the New Jersey Zinc Company. Proxies were solicited by the insiders who favored the sale and who in consequence sent the price of the stock to 80 cents. But when the special meeting was held on March 4 the proposition was quashed by the opposing stockholders, who had already received good dividends and had faith in the future of the property. This action weakened the stock for the time being, but in July there was a spurt to 95 cents. Later the market again eased off in sympathy with trading in other securities. Small Hopes has been in some request, although it has not paid a dividend in over three years. The shares were mostly traded in around 40 cents, though as much as 55 cents has been paid, while the low mark was 30 cents.

In the California section little has been done. Standard Consolidated continues to pay 10 cents quarterly, and has already returned in dividends more than twice its capitalization. The stock opened at \$3.85 in January, and after selling down to \$2.50 in February gradually rose to \$4 in July; but most dealings were at \$3.50 and lower. Brunswick Consolidated continues to call assessments as operations are unproductive. This year 9 cents has been levied, making the total to date 62 cents on the par value of \$1. Consequently the shares are now down to 3 cents, which is the lowest price in years. Quicksilver shares showed some business, though insiders do not encourage trading. The usual 50-cent dividend has been paid on the preferred stock, but nothing has been declared on common. In March the preferred stock rose to \$11 $\frac{1}{2}$, and the common to \$4 $\frac{1}{4}$, which were the highest marks this year. In October, however, preferred sold down to \$8 and common to \$2.

In the Comstock stocks prices have been forced down by the perpetual assessment policy. It is surprising how the public will continue to carry stocks that can never return in dividends what they have collected in assessments. Some of these shares are selling for the amount of their current assessment, while others are in such a financial plight that they must eventually sell for a song. Of the higher priced stocks, Consolidated California & Virginia leads. This company has re-entered the assessment list, after having paid a dividend about a year ago. Consequently, the price of the shares dropped \$1 from January to November, when 80 cents was quoted, but in December there was a recovery to \$1.35, assessment of 25 cents paid. Ophir, having levied 30c. this year, sold down from \$1.80 in May to 85 cents in October, but in December rallied to \$1.40, assessment of 15 cents paid. Best & Belcher, though it was assessed at 50 cents, shows better form, and after selling rather low for many months, has advanced to \$1.05 in December. Mexican, with 30 cents in assessments, is also higher, advancing to 87 cents in November, from 20 cents in August. Speculation fostered these advances. The other Comstock stocks were uninteresting here, though there was a general advance in San Francisco.

Alice, of Montana, has met reverses, as the property has not yielded so well lately, and no dividends have been paid in years. The market value of the shares dropped to 25 cents in November. Moulton appeared at long intervals, selling up to 30 cents.

In early February the United States Reduction

PRICES OF INDUSTRIAL AND COAL STOCKS IN NEW YORK AND PHILADELPHIA DURING 1902.

Name of Company.	Par Value	January	February	March	April	May	June	July	August	September	November	December	Sales.
Allie-Chalmers, pf.	100	20.00	21.00	22.50	22.00	23.50	25.00	25.00	25.00	22.50	21.00	19.00	22,137
Amer. Agri. Chem.	100	80.00	82.50	85.00	82.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	1,383
Amer. Chem. pref.	100	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	16,086
Amer. Cement.	10	4.38	4.38	4.38	4.38	4.38	4.38	4.38	4.38	4.38	4.38	4.38	3,408
Amer. Sin. & Ref. pref.	100	49.13	44.75	46.25	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	58,882
Am. Steel & Wire	100	95.00	97.13	99.00	96.13	98.00	98.00	98.00	98.00	98.00	98.00	98.00	145,225
Cambria Steel	100	85.00	87.88	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	8,115
Colo. Fuel & Iron	100	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	822,240
Col. H. C. & Iron	100	88.25	84.00	84.00	84.00	84.00	84.00	84.00	84.00	84.00	84.00	84.00	3,221,870
Crucible Steel	100	17.13	18.50	19.88	19.88	20.25	21.75	21.75	21.75	21.75	21.75	21.75	185,033
Crucible Steel pref.	100	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	95,232
International Pump	100	62.00	62.00	62.00	62.00	62.00	62.00	62.00	62.00	62.00	62.00	62.00	60,020
Int'l Pump pref.	100	90.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	85.00	45,883
Mon. R. Con. C. & O'ke	100	13.75	13.25	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	11,035
Nat'l Lead	100	44.00	44.00	44.00	44.00	44.00	44.00	44.00	44.00	44.00	44.00	44.00	109,458
National Lead pref.	100	19.63	15.38	15.38	15.38	15.38	15.38	15.38	15.38	15.38	15.38	15.38	415,217
Penn. Steel pref.	100	86.00	87.00	87.00	87.00	87.00	87.00	87.00	87.00	87.00	87.00	87.00	33,175
Phila. Nat. Gas	100	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	20,449
Phila. Nat. Gas pref.	100	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	15,510
Pittsburgh Coal	100	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	3,715
Pittsburgh Coal pref.	100	92.75	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	180,500
Republic & Steel	100	17.50	16.13	16.13	16.13	16.13	16.13	16.13	16.13	16.13	16.13	16.13	80,017
Steel & Wire pref.	100	70.00	68.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	703,800
Shaw-Walker	100	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	256,016
Shaw-Walker & I. pf.	100	83.00	83.00	83.00	83.00	83.00	83.00	83.00	83.00	83.00	83.00	83.00	124,455
Standard Oil	100	700.00	680.00	680.00	680.00	680.00	680.00	680.00	680.00	680.00	680.00	680.00	14,428
Suag. Iron & Steel	10	2.00	1.63	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1,561
Tenn. Coal I. & B. H.	100	67.25	61.50	71.25	67.25	71.25	71.25	71.25	71.25	71.25	71.25	71.25	1,855,975
United Gas Imp. Pipe	100	115.00	115.00	122.00	120.00	122.00	122.00	122.00	122.00	122.00	122.00	122.00	170,782
U. S. C. I. P. pref.	100	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	49,803
U. S. Red & Ref.	100	46.75	46.75	46.75	46.75	46.75	46.75	46.75	46.75	46.75	46.75	46.75	41,727
U. S. Red & Ref. pf.	100	66.50	63.75	63.75	63.75	63.75	63.75	63.75	63.75	63.75	63.75	63.75	5,378,233
U. S. Steel Corporation	100	46.75	41.63	43.50	40.88	42.13	42.13	42.13	42.13	42.13	42.13	42.13	2,530,645
U. S. Steel pref.	100	97.75	92.38	95.50	92.50	92.38	92.38	92.38	92.38	92.38	92.38	92.38	418,622
Virginia-Car Chem.	100	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	31,674
Ya-Car Chem. pref.	100	125.50	120.00	123.00	120.00	123.00	123.00	123.00	123.00	123.00	123.00	123.00	22,657
Westhouse E. & M.	50	177.50	173.50	173.50	173.50	173.50	173.50	173.50	173.50	173.50	173.50	173.50	2,850
West. E. & M. pref.	50	187.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00	2,850

* Ex. Privileges. Total sales, 18,243,354 shares.

penses in connection with the erection of the new mill, and elaborate mining operations. Elkton Consolidated has lost heavily, trouble with water in the lower levels of the property having cut off dividends. The last payment was 4 cents

price of the stock dropped to 23 cents in the first half of the year, but later inside support raised the market to 41 cents. In December, however, the price is again lower at 28 cents. Mollie Gibson, of Aspen, has met with misfortune. The

& Refining Company, the so-called Cripple Creek, Colo., mill combination, was listed on the New York Stock Exchange. The 6 per cent preferred stock, of which there is \$4,000,000, brought at the opening sale \$63 3/4 @ \$64 5/8, and the common, of which \$6,000,000 is authorized, \$38 1/2 @ \$40. The first 1/2 per cent quarterly dividend on the preferred stock was paid on January 1, 1902, and 1 per cent on common on April 1. There is also a bond issue of \$3,000,000, carrying 6 per cent interest. At the close of the year the common shares stood at \$32 1/2, and the preferred at \$50.

The American Smelting and Refining Company, known as the smelter trust, paying 7 per cent on its preferred stock, but nothing on the common, has not touched the high-level in the share market as in 1901. The depressed metal market accounted for this no doubt. The highest point for the preferred stock was \$100 1/4, and the lowest \$85, both recorded in June. The common shares were \$49 3/4 in May, and \$36 7/8 in November. St. Joseph and Doe Run Lead, of Missouri, 6

of Arizona, at \$6, and \$2,000 first mortgage 6 per cent gold bonds of the Nipper Consolidated Copper Company, of Montana, at 105.

THE BOSTON MINING STOCK MARKET IN 1902.

By Our Special Correspondent.

The average holder of mining stocks, particularly copper shares, has had very little to be thankful for, as a result of the year's operations. Not only has he seen the income from this class of investments reduced, and in some cases entirely wiped out, but he has also seen the market value of the principal fade away materially. Indeed, the principal in a few remote cases is hardly discernible, while in others but a part of its former value is left. One thing can be said, however, a large part of the mining shares listed in this market have been taken up and paid for by holders, and consequently brokers' accounts are in very good shape. From a speculative point

1899, the time of the last copper boom. Amalgamated made an extreme fluctuation of \$25.75 during the year, varying from \$78.87 1/2 to \$52.12 1/2. The steady advance of this security the latter part of the year to above \$63.50 per share is considered significant, as it is thought to mean the ending of a long continued warfare with the outside producers. Attempts were made several times to reach an amicable settlement, but each time all efforts were of no avail. Another dividend is due on Calumet, and, according to precedent, \$5 ought to be declared, which would bring this year's payments up to \$25, against \$45 in 1901. The last three payments have been \$5 each. Tamarack and Osceola, two of Boston's pets, and with the same management, dropped out of the dividend list altogether during the year, and there has been a resultant loss in the market value of these stocks. Each has been cut in half during the 12 months, Tamarack touching \$140 per share and Osceola \$47.50. The recovery in each has been slight. The talk that ema-

FLUCTUATIONS IN MINING STOCKS IN COLORADO SPRINGS, COLO., DURING 1902.

Name of Company*	January		February		March		April		May		June		July		August		September		October		November		December		Sales.
	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	
Aeolia	.14	.11 1/2	.12	.10 1/4	.11	.10	.10	.08	.11	.05	.10	.09	.10	.06	.09	.05 1/2	.11 1/2	.09	.09 1/2	.07 1/4	.09 1/2	.07 1/2	.08 1/2	.07	199,166
Alamo	.14	.12	.13 1/2	.10	.08	.03 1/2	.05	.03	.03 1/2	.03	.03 1/2	.03	.03 1/2	.03	.03 1/2	.02 1/2	.04 1/2	.03	.05	.03 1/2	.04 1/2	.03	.04	.03 1/2	313,000
Am. Con.	.04 1/2	.02	.03	.02	.03	.02	.03 1/2	.02	.02 1/2	.01 1/2	.02 1/2	.02	.02 1/2	.01 1/2	.02	.01 1/2	.02 1/2	.02	.03	.02 1/2	.03	.02	.02	.01	157,000
Anaconda	.35	.20	.30	.27 1/2	.25	.20	.21	.14	.19	.13	.20	.16 1/2	.20	.12	.20	.12 1/2	.22 1/2	.16	.21 1/2	.14	.20	.15	.20	.16 1/2	100,800
Ben Hur	.06	.04	.06	.04	.06	.03 1/2	.05 1/2	.04	.04 1/2	.03	.04 1/2	.03	.04 1/2	.03	.04	.02 1/2	.04	.01	.04 1/2	.03	.03 1/2	.03 1/2	.02 1/2	.01 1/2	184,500
Black Belle	.09	.07	.08	.06	.09	.04	.08 1/2	.06	.07	.05	.07	.05	.04	.01 1/2	.03	.01	.09 1/2	.05	.08	.04	.07 1/2	.04	.07	.03	30,500
Blue Bell	.12	.07	.10	.08	.10	.07	.08 1/2	.06	.09	.04	.09	.03	.09	.05	.07 1/2	.03	.10	.06	.09	.06	.07	.05	.04 1/2	.04	40,500
C. K. & N.	.04	.02	.03 1/2	.02 1/2	.03 1/2	.03 1/2	.05 1/2	.06	.07	.05 1/2	.06 1/2	.06	.05 1/2	.05	.06 1/2	.05	.10 1/2	.07	.10	.08 1/2	.10	.05	.12	.09	1,115,100
C. C. Con.	.09	.12	.10	.08 1/2	.09	.07 1/2	.08	.06 1/2	.07	.06	.07 1/2	.06	.06 1/2	.06	.06 1/2	.05	.09 1/2	.07	.07 1/2	.06 1/2	.07 1/2	.06	.06 1/2	.05	305,500
Dante	.05 1/2	.04	.05	.04	.04 1/2	.03 1/2	.05 1/2	.04 1/2	.04 1/2	.03 1/2	.04 1/2	.03	.03 1/2	.03	.03 1/2	.03	.01 1/2	.04 1/2	.03	.03 1/2	.03	.03 1/2	.03	.04	207,000
Dr. Jack Pot	.44	.40	.44 1/2	.39	.50	.42 1/2	.48	.33	.40	.19 1/2	.19 1/2	.14	.10	.10	.11 1/2	.12 1/2	.10	.13 1/2	.13	.13 1/2	.11	.11 1/2	.08	.10	1,039,700
Elkton	1.19	1.12 1/2	1.40 1/2	1.27	1.31	1.15	1.10	.75	.74	.57	.65	.61	.59 1/2	.55	.48	.33	.40	.35	.38 1/2	.35	.36	.33	.36	.30	1,848,657
El Paso	.60	.55	.65	.56	.58	.53	.55	.43 1/2	.50	.45	.55	.53 1/2	.53	.51	.64	.60	.73	.63	.73	.69	.71	.66	.70	.60	1,028,584
Fanny Rawlings	.11	.07	.15	.10	.12	.05	.10	.05	.07	.03	.06	.03 1/2	.07	.05 1/2	.05 1/2	.04	.07	.04	.06	.05 1/2	.05	.04	.09 1/2	.03	85,325
Findley	.12	.09	.12	.11	.12	.09	.11	.10	.10 1/2	.08	.09	.08	.12	.08	.09	.01	.12	.08	.10	.08	.10	.07	.10	.08	346,000
Gold Dollar	.09 1/2	.07	.07	.06	.07	.05	.05 1/2	.03	.05	.02	.06 1/2	.04	.04 1/2	.03	.04	.03	.05 1/2	.04 1/2	.04 1/2	.04	.05	.04 1/2	.05	.04 1/2	510,500
Golden Cycle	.68	.55	.70	.55	.71	.68	.70	.61	.65	.62	.66	.60	.62	.57	.70	.56	.70	.58	.75	.55	.63	.59	.62	.59	289,750
Golden Fleece	.80	.40	.69	.36	.50	.25	.50	.25	.45	.20	.25	.10	.18	.10	.25	.10	.25	.10	.25	.10	.25	.12	.12	.05	165,500
Gold Sovereign	.04	.03	.03 1/2	.03 1/2	.04	.02 1/2	.03	.02 1/2	.02 1/2	.03	.02 1/2	.03	.02 1/2	.03 1/2	.03	.02 1/2	.02	.06	.04 1/2	.03	.03 1/2	.02 1/2	.05	.02 1/2	222,500
Iron Clad	.06	.02	.05	.04 1/2	.05	.02 1/2	.03 1/2	.02	.03 1/2	.02 1/2	.03 1/2	.03	.03 1/2	.03	.03 1/2	.02	.03 1/2	.03	.03	.02 1/2	.04	.02 1/2	.04	.02 1/2	31,000
Isabella	.35	.27	.33	.27	.25 1/2	.23	.27	.24 1/2	.34	.15	.31 1/2	.26	.29	.28 1/2	.38	.25 1/2	.37 1/2	.32	.35 1/2	.34	.35	.30 1/2	.33	.30	1,620,750
Jack Pot	.36	.30	.39	.29	.35	.29	.35	.28	.25 1/2	.15	.17	.10	.12	.09 1/2	.14	.10	.16	.10	.13	.12	.18	.11	.12	.08	420,900
Last Dollar	.55	.45	.60	.45	.60	.40	.60	.40	.60	.40	.60	.45	.75	.40	.80	.50	.77	.55	.75	.40	.65	.45	.65	.45	41,500
Lexington	.06	.05 1/2	.08	.07 1/2	.08 1/2	.05 1/2	.08 1/2	.05 1/2	.06 1/2	.06	.06	.05 1/2	.07	.05	.05	.04	.06 1/2	.05	.07 1/2	.05	.05 1/2	.04	.06	.04 1/2	419,900
Little Puck	.06	.04	.07	.05	.06 1/2	.05	.07	.05	.06	.05	.07	.05	.05 1/2	.04	.05	.04	.06	.04	.05 1/2	.05	.05	.04	.04 1/2	.03	205,900
Mollie Gibson	.20	.16	.20	.14	.14	.10	.14 1/2	.10	.15	.10 1/2	.20	.10	.14	.12	.12	.09	.06 1/2	.06	.05 1/2	.04	.08	.04 1/2	.08	.04 1/2	154,500
Moon Anchor	.25	.19	.21	.18	.30	.15	.20	.13 1/2	.15	.10	.15	.10	.14	.10	.14	.12	.10 1/2	.10	.10	.05	.10	.06	.06	.05	59,800
Morning Star	.04	.03	.03 1/2	.03 1/2	.03 1/2	.02 1/2	.03 1/2	.02	.02 1/2	.01 1/2	.02 1/2	.01 1/2	.02 1/2	.02 1/2	.03	.02 1/2	.04 1/2	.04	.04 1/2	.04	.07	.04 1/2	.05	.04	229,500
National	.04	.02	.02 1/2	.02	.02 1/2	.02 1/2	.03	.01 1/2	.02	.01 1/2	.02 1/2	.01 1/2	.02	.01 1/2	.02	.01	.02	.01	.02	.01	.04	.01 1/2	.01	.01	135,100
Nellie V.	.04 1/2	.02	.04	.02 1/2	.03	.02 1/2	.02 1/2	.02 1/2	.02 1/2	.01 1/2	.02 1/2	.01	.02	.01	.03	.02 1/2	.04	.03	.02	.01 1/2	.02	.01	.02	.01	200,750
New Haven	.05	.03 1/2	.04	.03 1/2	.04 1/2	.02	.04	.03 1/2	.03 1/2	.02 1/2	.04	.03 1/2	.03 1/2	.02 1/2	.03	.02 1/2	.03 1/2	.03	.03	.02 1/2	.03 1/2	.01 1/2	.02	.02	132,200
Pappoose	.03	.02 1/2	.03	.01	.03	.01	.03 1/2	.02	.02	.01	.02 1/2	.01	.02	.01 1/2	.02	.01 1/2	.03	.01	.02	.01 1/2	.03	.01	.02	.01	24,600
Pharmacist	.06	.04 1/2	.07	.04 1/2	.04 1/2	.03 1/2	.04 1/2	.04	.04 1/2	.03	.04	.03 1/2	.04	.03	.03 1/2	.03	.06 1/2	.05	.06	.04	.06	.05	.04 1/2	.04	218,400
Plumacle	.09	.07	.08	.06	.07	.05	.07	.05	.06 1/2	.05	.07	.05 1/2	.07 1/2	.05	.05 1/2	.05	.07	.05	.07	.06	.06	.04	.06	.04	115,000
Pointer	.04	.03	.03 1/2	.03	.04	.03 1/2	.03	.02 1/2	.02 1/2	.02 1/2	.03 1/2	.02	.02	.01 1/2	.02 1/2	.02	.03 1/2	.03	.02 1/2	.02	.02 1/2	.01 1/2	.02	.01 1/2	241,400
Portland	2.90	2.10	2.70	2.57	2.60	2.35	2.05	1.96	1.92	1.75	2.00	1.75	1.90	1.76	1.90	1.75	2.00	1.95	2.06	1.80	2.00	1.85	2.02	1.80	156,411
Prince Albert	.04	.03 1/2	.04	.02 1/2	.03 1/2	.02	.03	.02 1/2	.03 1/2	.03	.02 1/2	.02	.02 1/2	.02	.03	.01	.03	.02 1/2	.03 1/2	.02 1/2	.03 1/2	.03	1.92	1.80	257,250
Republic	.04	.03	.03 1/2	.02	.03	.01	.03	.02	.02 1/2	.01 1/2	.03	.01 1/2	.03	.01	.03	.02	.04 1/2	.01 1/2	.04	.02 1/2	.03	.01	.03 1/2	.01 1/2	124,000
Rose Maud	.07	.05	.05	.04 1/2	.04 1/2	.03	.05	.03 1/2	.03 1/2	.01 1/2	.02 1/2	.01	.03	.01	.03	.01 1/2	.03 1/2	.03	.04 1/2	.03	.03 1/2	.02	.02 1/2	.01	78,500
Sunset Eclipse	.10 1/2	.07 1/2	.12	.08	.13 1/2	.09	.10 1/2	.07	.07 1/2	.03	.03 1/2	.02 1/2	.03 1/2	.02 1/2	.03 1/2	.02 1/2	.04 1/2	.01 1/2	.03 1/2	.02	.03	.02	.02	.01	641,200
Uncle Sam	.02 1/2	.01 1/2	.03	.01 1/2	.02	.01	.02	.01	.03	.01	.02 1/2	.01	.02	.01	.02	.01	.02 1/2	.02	.02 1/2	.02	.02	.01	.03	.01	168,700
Vindicator	1.26	1.19	1.22	1.14	1.20	1.13	1.14	1.01	1.00	.85	.85	.90	.85	.93	1.10	.90	1.05	.98	1.10	1.02	1.25	1.00	1.07	.98	86,000
Work	.10	.08 1/2	.09 1/2	.06	.08 1/2	.06	.07 1/2	.06	.07 1/2	.05	.07	.05 1/2	.07	.04 1/2	.06 1/2	.04 1/2	.09 1/2	.05 1/2	.08 1						

has been a favorite, and its name has been often coupled with that of Trimountain. The owners of the latter are believed to have a large interest in Copper Range. The latter has varied from \$43.75 to \$65.25, and finishes the year close to \$60 per share. This company has the benefit of a railroad, which is rapidly developing into a large earner of money. It has a large treasury surplus. Atlantic Mining stock has been watered, so that a fair comparison cannot be made in true value, although the parity at present is not far from the lowest price of the year.

Bingham Consolidated and United States Mining, two Utah properties, have been steadily de-

struction, and has fallen 50 per cent to \$12.50, with a \$2 recovery. Mass Mining has not met expectations in its mill returns, and is suffering from a short-sighted policy pursued by the management in not opening up the mine properly before starting its mill. It has fluctuated from \$21.50 to \$12.50, closing the year close to \$15 per share. There have been no particular developments in Centennial, although the stock has moved with the temper of speculation. Its range has been from \$28 to \$11. No change has occurred in the status of the Arcadian Mine during the year. Early in the period mentioned the stock rose to \$13.25, but has fallen back to \$4

tember, closing close to \$40 per share. Parrot has paid but one dividend of 50 cents per share. It has fluctuated from \$34 per share early in the year to \$20.75 with subsequent rally to above \$27 per share.

Unquestionably the physical condition of the Old Dominion Mine has been bettered by the change in its management last spring, when it was taken out of Bigelow hands. Better terms have been made with the railroad for hauling freights, and expenses have been minimized in all directions. These have not been reflected in the market price of the stock, however, but are accruing, and may show later. Its range has been

FLUCTUATIONS IN MINING STOCKS IN BOSTON DURING 1902.

Table with columns: Name of Company, Par-Value, and monthly price fluctuations (H, L) from January to December, plus Sales. Rows include Copper, Gold, Zinc, and Miscellaneous stocks.

(a) Montana; (b) Michigan; (c) Arizona; (d) Colorado; (e) California; (f) Nova Scotia; (g) Missouri; (h) Utah; (i) British Columbia; (j) New Mexico; (k) Tennessee; (l) Mexico; (m) West Virginia. Total sales, 5,470,944 shares.

veloped, and in the case of the latter the smelter has just started in to make matte shipments to the East. Both stocks are very well held, but the United States has a very game crowd behind it, which are willing to help along the stock market end when conditions warrant it. Bingham people do very little in this direction. Bingham has fluctuated from \$39.75 to \$20.50, ending the year close to \$30 a share, and United States has varied from \$22.87 1/2 to \$14.25, closing the year at about its best. Lawson's Trinity has been a sore disappointment, falling over \$10 to \$8 per share during the year, with but a feeble rally. Little is known regarding the mining end. Adventure has been handicapped by poor mill con-

struction. Franklin Mining has had the usual reverses with the question of mining at a profit problematical. Its price has ranged from \$15.75 to \$7.50. Isle Royale has proven disappointing, and the ore has hardly run 1 per cent. The price changes have been between \$25 per share and \$9.75, the final for the year, not being far from the lowest. This is also a Bigelow managed property, and rumors have been rife during the year regarding its condition. Mohawk has done fairly well, so far as its price is concerned. Fresh assessment money was paid early in the year, and its mill has been completed, but another assessment is likely to be called before long. It rose from \$27, January 14, to \$49 per share in Sep-

tember, closing close to \$40 per share. Parrot has paid but one dividend of 50 cents per share. It has fluctuated from \$34 per share early in the year to \$20.75 with subsequent rally to above \$27 per share. Unquestionably the physical condition of the Old Dominion Mine has been bettered by the change in its management last spring, when it was taken out of Bigelow hands. Better terms have been made with the railroad for hauling freights, and expenses have been minimized in all directions. These have not been reflected in the market price of the stock, however, but are accruing, and may show later. Its range has been

may be heard from later. Shannon has varied from \$18 to \$8, but the market has been narrow. Allouez fluctuated between \$4.75 and \$2.

The United States Oil Company went into the coal mining business during the year, purchasing a large tract of land containing coal deposits. The corporate name was changed and additional stock put out and taken by influential people. A railroad is being built and the property is being rapidly developed with an idea to early production. The oil end has been well maintained, but the advance in the commodity has not been reflected in the price of the stock. It sold at \$11.25 the first of the year, and touched \$18.25 for high in July. Its present price is close to \$14 per share.

The control of the Dominion Coal and of Dominion Iron and Steel companies has gone to Montreal and Toronto people, and price changes in both were violent at times, particularly the latter. Dominion Coal rose from \$54 in January to \$146 in August, but receded to below \$120 per share subsequently. Dominion Iron rose from \$25 to \$79.87½, but lost over one-half of the advance later, closing the year around \$60 per share. Dominion Iron has been a highly speculative stock.

But three Lake Superior mines paid dividends during 1902, aggregating but \$3,440,000, or less than one-half paid in 1901 by six companies. Of the three Calumet's payment alone was \$2,500,000. This is remarkable for a year of general business prosperity. In 1899 five Lake companies paid \$12,318,000, of which Calumet paid \$4,500,000. This is the practical result of combine operations, and does not make a pleasant record or pleasant situation. Three Montana companies paid \$2,214,925. Not since 1895 have disbursements by copper mining companies been so small. The disastrous results of Amalgamated's artificial copper policy are also illustrated when it is taken into consideration that 19 copper mining companies show a shrinkage of over \$250,000,000 in market value from former high prices to recent low ones. Thirty-three Lake Superior copper mining companies are listed on the Boston Stock Exchange, which is within three of one-half the total number of mining stocks listed here.

THE LONDON STOCK MARKET DURING 1902.

By EDWARD WALKER.

The chief features of the London mining stock market during 1902 have been the absence of any boom in South Africans on the conclusion of the war, the clearing up of the Whitaker Wright wreckage, the disappointing results at the Le Roi and other British Columbian mines, and the reduction of dividends of the copper companies consequent on the fall in the price of copper.

The dullness of all South Africans has been a great disappointment to the speculator. At the beginning of the year, when the war was progressing rapidly by the steady captures from the enemy, there was a good deal of activity, and in many quarters shares were being bought for the rise that was expected when the war was over. This rise never took place, and since last May the African market has been at one dead level. The public realized that the country and the mining industry will take a long time to recuperate from the effects of the war, and that there is practically no chance of any rise in the prices of shares in the near future. The reports that have since come to hand with regard to the difficulty of inducing the natives to return to work and to the high cost of living, owing to the land having been denuded and the consequent importation of supplies, has certainly justified this attitude of aloofness from the speculative market. Then again the uncertainty with regard to the burden of taxation to be borne by the mines has prevented moneyed men from committing themselves. The death of Cecil Rhodes was not a disturbing factor in the market, as it was not alto-

gether unexpected, and no part of his estate has come on the market. It served to revive the rumor of the absorption of the Chartered Company by the Imperial Government. This is a step that cannot, however, be undertaken in the near future, as the resettlement of the Transvaal and the Orange River Colony fully occupies the attention of the home authorities. The visit of Mr. Chamberlain to South Africa is looked upon as a guarantee of the settlement of the country on a permanent basis, though at first it was considered that it would unnecessarily delay the decisions of policy to be pursued in connection with the mining industry. The Rhodesian market has been affected very little by the war. Several new companies have been formed to work specific mines and to interest the public in the shares of others. A good deal of money has been spent on equipment of new gold properties and in prospecting and developing copper propositions. In the spring the Dunraven Mine closed down, owing to exhaustion, an unfortunate event that happened just as a boom was in preparation for Rhodesians generally. No high-grade gold property has yet been opened up in that country. The veins so far developed are comparatively low grade, and need large capital to work.

The Indian section has received a good deal of attention this year. The shares of the established mines have been strong and new capital has been subscribed for various purposes. Perhaps the most important event has been the inauguration of the Cauvery Falls electrical installation, whereby power is supplied to the Kolar gold-fields from the falls 92 miles distant. Hitherto fuel has been expensive and labor poor in quality, and the saving in costs will be considerable under the new system. This plant was described in the Journal for December 27. Another important event is that the leases of the mines from the Mysore Government have been renewed for a further period of 30 years from 1910. The Mysore Gold Mining Company finding that its veins continue well in depth, but will in a few years' time pass out of their territory, has negotiated for the purchase of the adjoining land from the Gold-fields of Mysore, and has issued new capital for the purpose. The Coromandel Company has reconstructed in order to raise additional capital. For some years this company has worked in barren ground, but recent discoveries have placed the company in a favorable position once more, and the new capital is required to provide for putting the mine on a payable basis. The Indian companies still suffer occasionally from want of water. In the earlier part of the year some of the mines had to stop work from this cause.

The West Australian market after going through many volcanic eruptions in the way of changes of control and management during recent years, has settled down to business in rather better style during the past year. It will be remembered that last year Lake View Consols and other mines passed out of the hands of the Whitaker Wright group. Eventually Mr. Govett, a London stock broker, became chairman, and after a visit to the mine placed the management in the hands of Bewick, Moreing & Co. The report by this firm showed that the mine had been gutted and recommended additional capital outlay to put it on a working basis. This policy is now being pursued, and no doubt the mine will again become a dividend payer, though on a considerably less scale. The other mines in the district continue producers, and the sulphides are being worked in a systematic manner. The Great Fingall Mine in the Murchison District has come to the front during the year as a producer, and has taken a prominent position in the speculative market. The Whitaker-Wright collapse was still prominently before the public during the earlier part of the year. During 1901 the London & Globe, the British America, and other companies

were in voluntary liquidation, but as shareholders were dissatisfied, the liquidation was taken over by the bankruptcy officials. The public examination of the directors took place this year, and several judicial utterances were made commenting severely on the methods of finance pursued. Unfortunately the public prosecutor has not been induced to take proceedings against Whitaker Wright and the directors, so that apparently nobody is to be made to suffer for the many wrongs inflicted on shareholders.

The history of the Le Roi group has throughout the year been a succession of disappointments. About this time last year Mr. Freecheville's report for the new board that had taken the control from Whitaker Wright was published and caused consternation among shareholders and speculators, who thought they had a good thing. The report showed the ore in sight to be of very low grade, and to have been expensively worked. Many contradictory reports have been issued at various times during the year as to estimated and realized profits, and shareholders agree that the dividing line between profit and loss depends on several questions, any of which may affect the position seriously. Very little interest is now taken in the shares. A very similar history is to be recorded with regard to Le Roi No. 2. The two other Whitaker Wright companies, the Rossland Great Western, and the Kootenay Exploration, have been amalgamated, and the capital written down. The prospects of these four mines is not very promising, but it should be noted that no pains are being spared in putting things into shape, and the efforts of Messrs. Alexander Hill and A. J. MacMillan, who now direct the fortunes of the district, may yield better results than in the past. Other British Columbian mines operated from London have been disappointing. The Ymir, after paying substantial dividends, has had to be reconstructed in order to provide further capital for new plant and dead work. The Velvet has also been reconstructed, while the Hall Mines is unable to make a profit. Hopeful news comes from Snowshoe, but this company has not been in existence long, so its fortunes are not yet decided.

Among United States mines, Stratton's Independence has occupied the largest share in the attention of the public. Shareholders have been dissatisfied with the way in which the affairs of the company have been conducted. The contradictory reports of various experts have formed the subject of acrimonious discussions, and the somewhat uncertain tone of Mr. Hammond's reports have made it impossible for shareholders to judge their exact position. The company has retained a large amount of earnings, presumably to be used as reserve capital for the purchase of other properties. The unsatisfactory manner of administering Stratton's has deterred the public from going into Camp Birds. This company was formed some time ago, but the deal was only completed in the spring. No prospectus was advertised, and no very great efforts have been made by the underwriters to dispose of the shares. The Tomboy Company is now in good condition, owing to Mr. Herron's great bargain in securing an adjoining property of value at a cheap rate when the original property was showing signs of exhaustion. The Montana Mining Company continues to work the old stopes at Drumlummon, obtaining a small profit, but the new properties recently purchased are of lower grade than was expected and not much profit is made. The De Lamar Company also continues to extract ore from the old workings and to make a profit.

Among Mexican properties El Oro continues to yield excellent results. The Grand Central is, however, exhausted. Mesquital, Parral and Palmarajo, three companies that did very badly originally, are now in other hands, and with smaller capital, doing well and yielding returns to shareholders. A Mexican property that has not ful-

filled its promise is the Avino Mines. After expensive concentrating and smelting plant had been erected they were found useless for the class of ore, and Mr. Ottokar Hofmann has been called in to give suggestions for the future treatment of the ore.

Copper mining companies have yielded reduced dividends this year in consequence of the fall in copper. The two copper mines situated in South Africa, the Cape Copper and the Namaqua, have also suffered from the war, and have been placed in a still more unfavorable position. The Mountain Copper Company of California, in view of the approaching exhaustion of the deposit has been reconstructed with smaller share capital, but with redeemable debenture debt, the paying off of which out of profits will automatically reduce the share capital to a figure which will enable the company to acquire new properties without being overburdened with capital. The only new copper property introduced to the public during the year is the Capillitas, situated in the Argentine. The company is in good hands, and the grade of ore is high, but the question of transport will be a difficult one to settle and will probably cause embarrassment.

A new copper company that has been prominently before the public this year is the Etruscan Copper Estates, which was formed two years ago to acquire some old mines in Italy. A great deal of money was sunk in opening them up, but when the mines were examined by Bewick, Moreing & Co. on behalf of parties intending to subscribe for debentures in the earlier part of the present year, it was found that the veins were poor, though of considerable extent, and that the ore was unworkable, owing to the amount of zinc present. Mr. Alexander Hill also examined the properties and reported adversely. In spite of the verdict of these independent and admittedly capable experts, the directors and shareholders have decided to continue working the mines, on the principle that opinions are worth little or nothing, and that results are all that is convincing.

A company of considerable importance that has been publicly floated during the year is the Dunderland Iron Ore Company. It was introduced under influential auspices, and with large capital to acquire and work low-grade iron ore deposits in Norway, and to concentrate by the Edison magnetic process. The object sought was to obtain a new supply of iron ore for the English ironmasters, and for this reason the company received general support. It is doubtful, however, whether the concentration and briquetting can be done cheaply enough, and whether the briquettes will be satisfactory metallurgically.

As regards English mining, it may be mentioned that the St. Davids is the only gold mine now being worked in Wales. The Cornish mines have suffered severely from the fall in tin, and the Dolcoath has been obliged to devote its year's profits to further expenditure on capital account.

One of the Whitaker Wright companies, the Nickel Corporation, working properties in New Caledonia, was taken over last year by people connected with the London metal trade, and this year arrangements have been made to hand the control to the International Nickel Corporation, by the latter buying up large blocks of shares,

some owned by other bankrupt Whitaker Wright companies and others purchased from shareholders in exchange for stock in the American company.

The Hooley element has been unpleasantly prominent in the market this year. Two new companies have been floated by this group. One was the Spanish Tin Mining Company, which was formed to acquire mines and deposits in Orense, Spain. The claims put forward for the riches of the properties were somewhat extravagant, and the prospectus was very adversely criticised. The other was the Sapphire Corundum Company, which was formed to acquire corundum deposits in Canada. The capital was absurdly high, and after the public issue several of the directors resigned. The company has not yet commenced business, and the shareholders who parted with their money before they discovered that it was a Hooley promotion are taking steps to reduce the capital and to work the proposition on more business-like lines. The unfortunate shareholders who bought stock in the Siberian Gold-fields Company last year have been making strenuous efforts to put their company into shape. It will be remembered that the Russian Government would not grant the concessions when they found that Hooley was connected with the company. The company was, therefore, reconstructed as the Nerchinsk Gold Company, and the Hooley party obliged to retire from the board and to refrain from using their votes in the conduct of the business. The new company sent mining men to examine the properties, and their reports are far from hopeful. It is not probable that the shareholders will ever receive any of their money back.

Among metallurgical companies the Smelting and Refining Company, of Australia, deserves notice. This is a reconstruction of the Smelting Company, of Australia, which was formed some years ago as a custom smelter for silver-lead ores. Partly through bad business methods and partly owing to the difficulty of purchasing suitable ores the company ended in failure. The shareholders, however, did not see why their excellent smelting plant should lie idle, and with the help of other moneyed people and enterprising metallurgists, revived the industry. By obtaining reduction in transport charges and modifying the plant for other ores, the directors and managers have placed the reconstructed company on a more hopeful footing, and it is confidently expected that success will be eventually reached.

The Elmore oil concentration process has continued to attract the attention of mining companies. Several plants have been erected to treat copper ores in Norway, and the process is being worked out on a practical scale in North Wales. A company has been formed to work the process in Canada.

DIVIDENDS AND ASSESSMENTS IN 1902.

By CHARLES C. SCHNATTERBECK.

Many things contributed to cut down dividend payments in 1902; chief among these being a lower metal market, especially for copper and silver. The total paid, however, is still enormous, being \$150,663,472 reported by 157 American mining and metallurgical companies. In addition 17 Mexican prop-

erties paid \$2,239,265; 2 Central and South American gold mines, \$321,520, and 10 Canadian companies, \$1,284,044; making a total of \$3,844,829. Adding this amount to that reported by United States properties, we have a grand total of \$154,508,301 distributed as dividends by 186 companies, identified with the mineral industry on the American continent.

In this country the largest dividend was \$56,253,642 reported by the United States Steel Corporation as representing 7 per cent on its preferred stock and 4 per cent on the common.

Second place is held by the Standard Oil Company, which disbursed \$43,650,000, or 45 per cent, among its stockholders. In 1901 this concern paid 48 per cent.

In the gold, silver and lead list the American Smelting and Refining Company leads with \$3,500,000, or 7 per cent on its preferred stock. Another large payer is the Silver King Gold Mining Company, of Utah, which announces \$1,300,000, equal to 43.1-3 per cent on the capital stock. The Homestake Mine in South Dakota is paying less than heretofore, and in the past year reported \$1,058,400, or 5 per cent on its issued stock. With the September payment the company inaugurated a 3 per cent annual dividend basis.

The copper shares have suffered severely from the depression in metal prices, and in consequence dividends are among the smallest in some years. Amalgamated, of Montana, which pays dividends from earnings on stock held in the Anaconda, Boston & Montana, Parrot and other mines, has cut its original annual rate of 8 per cent to 2 per cent. Calumet & Hecla, of Michigan, also paid less, although its dividend amounts to \$25 per share, or 100 per cent on the issued capital.

The Virginia-Carolina Chemical Company, the Southern fertilizer combination, pays 8 per cent on its preferred stock, and 6 per cent on the common, placing it at the head of the miscellaneous chemical list.

In the coal and coke section the Pittsburg Coal Company and the Monongahela River Consolidated Coal and Coke Company, the Pittsburg, Pa., combinations lead, both paying 7 per cent. on their preferred shares.

It is also noteworthy that there are numerous small monthly dividend payers. In reporting these dividends we have ignored the declarations of companies selling stock and dividing the proceeds as profits. Were we to consider these latter "dividends," it would be a difficult matter to report the actual earnings from legitimate mining. Hence they had better be reported as commissions on the sale of stock.

Assessments have been less than last year, but the number of companies collecting shows an increase. In all 236 metal mines and petroleum companies have levied \$2,545,817 in 1902, of which \$885,750 was called by 92 California properties, \$751,142 by 38 from Nevada, \$730,925 by 99 from Utah, and the balance of \$178,000 by 7 companies in Colorado, Arizona, Washington and Alaska. With few exceptions these assessments have been levied by companies that make it a practice to call regularly on their stockholders. This is especially the case with the Comstocks, and some of the smaller Utah mines. Of course, much of the money collected by assessments is used in developing properties that may prove dividend payers, but there is some expended on mines that will never repay stockholders.

DIVIDENDS.—(\$1.00=\$1,000.)

Name of Company.	1900.	1901.	1902.	Grand Total.
Aberdeen, c., N. M.		\$32		\$32.175
Acacia, g., Colo.	\$45			45.000
Adams, S. L., Colo.	8	15	23	738.500
Aetna Con., g., Cal.	15			225.000
Ala., Con. Coal & I. pf., Ala.	175	175	135	568.750
Alaska Goldfields, g., B. C.		135		280.000
Alaska-Mexican, g., Alaska.	36			465.381
Alaska-Tread, g., Alaska.	300	300	300	5,120.000
Allis-Chalmers, pf.		569	1,138	1,706.250
Alpha Oil, Cal.		1		1.250

Name of Company.	1900.	1901.	1902.	Grand Total.
Altoona Coal & Coke, Pa.		\$75		\$75.000
Amalgamated, c., Mont.	6,000	8,304	3,947	19,656.837
Amanda, g., Colo.	10			10.000
Amer. Agric. Chem., pf.	1,020	1,025	1,028	3,582.800
American Cement, Pa.	80	80	160	380.000
American Coal, Md.	255	150	150	1,282.500
American Fuel Oil, Cal.	12	1		16.000
Amistad y Concordia, Mex.		17	63	79.030
Am. I. & St., com., Pa.		19	10	256.100
Am. I. & St., pf., Pa.		150	150	450.000
Am. Sm. & Ref., pref.	1,545	2,709	3,500	8,891.553

Name of Company.	1900.	1901.	1902.	Grand Total.
Anaconda, c., Mont.	4,800	3,900	1,200	22,050.000
Annie Laurie, g. s., Utah.			60	60.000
Argonaut, g., Cal.	70			490.000
Arizona, c. s., Ariz.	576	800	1,115	3,445.468
Arrow, g., Colo.		50		50.000
Atlantic, c., Mich.		80		940.000
Aztec Oil, Cal.		12	16	16.450
Bald Butte, g., Mont.	153	180	180	1,297.148
Bankers, g., Colo.		188		187.500
Bartolome de Medina, Mex.			20	63.483
Big Four, g., Colo.	15			15.000

DIVIDENDS.—Continued.

Table with 16 columns: Name of Company, 1900, 1901, 1902, Grand Total, Name of Company, 1900, 1901, 1902, Grand Total, Name of Company, 1900, 1901, 1902, Grand Total. Lists various mining and oil companies and their dividend payments for 1900, 1901, and 1902, along with their grand totals.

c.—Copper. g.—Gold. i.—Iron. l.—Lead. q.—Quicksilver. s.—Silver.

ASSESSMENTS.

Table with 16 columns: Name of Company, 1900, 1901, 1902, Grand Total, Name of Company, 1900, 1901, 1902, Grand Total, Name of Company, 1900, 1901, 1902, Grand Total. Lists various mining and oil companies and their assessment amounts for 1900, 1901, and 1902, along with their grand totals.

ASSESSMENTS.—Continued.

Table with 5 columns: Name of Company, 1900, 1901, 1902, Grand Total. The table lists numerous mining and engineering companies and their financial assessments for the years 1900, 1901, and 1902, along with their grand totals. The entries are organized in three columns across the page.

c.—Copper. g.—Gold. i.—Iron. l.—Lead. q.—Quicksilver. s.—Silver.

TRADE CATALOGUES.

The Grasselli Chemical Company, of Cleveland, O., issues a pamphlet of unique and artistic design, which gives information about the history of the company and specifies various chemicals manufactured. The list includes sulphuric and hydrochloric acids, Glauber salts, nitric acid, zinc sulphate and chloride, copper sulphate, glycerine, acetic acid and ammonia and ammonia chloride.

Pure boiler water without chemicals or compounds, the Duquesne Manufacturing Company, of Pittsburg, Pa., claims is obtained by the use of the Gunning mechanical water purifying system. The manufacturers state that the system insures no boiler cleaning, no dirt in boilers, a saving of from 10 to 40 per cent in fuel, and a saving from 80 to 95 per cent in repairs. Circulars sent out by the company call to the Gunning system and its use in some large Pittsburg buildings.

The Pratt & Whitney Company, of Hartford, Conn., issues a finely illustrated pamphlet of 42 pages, describing its thread milling machine, designed for making precision screws, worms, feed screws, springs and spiral gears; also for threading on such work as rock drill feed screws, thrust screws for friction hoist drums, valve stems and the like, in which low cost of manufacture is a prime consideration. The company states that the machine possesses practically all the flexibility and adaptability to miscellaneous thread cutting of an engine lathe, does the work within narrower limits of error than any ordinary engine lathe, and at a fraction of the cost of engine lathe work. The construction of the machine is shown in detail, with samples of the work it does.

Wickes Brothers, of Saginaw, Mich., manufacturers of boilers, heaters and boiler shop tools, have issued a second edition of their general catalogue as a cloth bound book of 184 pages. The book opens with a general description of the company's works at Saginaw, and gives information upon the selection of a boiler with a description of the Wickes patent safety tube boiler, showing its merits in detail. Other chapters in the book are on marine boilers, fuels, including wood, sawdust, petroleum, gas and coal, chimney draught, water and its impurities, the character and properties of steam, horse-power of boilers, steam boiler and pipe coverings, and standard methods of making boiler trials. Constant reference is made to prominent authorities. The book is entitled "Modern Steam Generators," and is entirely different from the ordinary run of trade catalogues, being really a work worthy of perusal by all mechanical engineers, and owners of boiler plants.

METAL MARKET.

New York, Jan. 1.

Financial Notes of the Week.

The tables giving the average prices of silver, copper and other metals for December and for the year 1902 will be found in the yearly reviews of the metal markets, given on other pages of this number.

The silver market has been poor the past week, with a slight tendency to advance. Indian rates have improved, and the probability of purchases from that quarter seem to be better.

The United States Assay Office in New York reports receipts of 26,000 oz. silver for the week.

OTHER METALS.

Daily Prices of Metals in New York.

December.	Silver		Copper				Spelter	
	Sterling Exchange	N. Y. Cts.	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.	Tin, Cts. per lb.	Lead, Cts. per lb.	N. Y. Cts.
25	47 1/2	47 1/2	11 1/2	11 1/2	52 1/2	26 1/2	4.05	4.02
26	47 1/2	47 1/2	11 1/2	11 1/2	52 1/2	26 1/2	4.10	4.02
27	47 1/2	47 1/2	11 1/2	11 1/2	52 1/2	26 1/2	4.05	4.02
28	47 1/2	47 1/2	11 1/2	11 1/2	52 1/2	26 1/2	4.10	4.02
29	47 1/2	47 1/2	11 1/2	11 1/2	52 1/2	26 1/2	4.05	4.02
30	47 1/2	47 1/2	11 1/2	11 1/2	52 1/2	26 1/2	4.10	4.02
31	47 1/2	47 1/2	11 1/2	11 1/2	52 1/2	26 1/2	4.10	4.02

London quotations are per Long Ton (2,240 lbs.) standard copper, which is now the equivalent of the former g. m. b's. The New York quotations for electrolytic copper are for cakes, ingots or wirebars; the price of electrolytic cathodes is usually 0.25c lower than these figures.

Copper.—Contrary to the usual custom at the end of the year the market has been very active throughout the week, and a large business has been done at advancing figures, both for home trade and export. It seems that stocks of refined copper in first hands are comparatively small, while business in all lines

continues very brisk indeed. At the close we quote Lake copper at 11 1/4@12c.; electrolytic in cakes, ingots and wirebars at 11 1/2@11 3/4c.; in cathodes, at 11 1/2@11 3/4c.; casting copper, at 11 1/2@11 3/4c.

The foreign market continues very strong and advancing. Standard copper in London opened at £52 2s. 6d., and the closing quotations on Wednesday are cabled at £52 15s. @£52 17s. 6d. for spot, £53 2s. 6d. @£53 5s. for three months.

Refined and manufactured sorts we quote: English tough, £55@£55 10s.; best selected, £56 5s. @£56 15s.; strong sheets, £68@£68 10s.; India sheets, £70@£70 10s.; yellow metal, 6 1/4@6 1/2d.

Imports of copper into the United States for the 11 months ending November 30, with re-exports of imported copper, are stated by the Bureau of Statistics of the Treasury Department as below, in long tons of 2,240 lbs.:

Fine copper:	1901.	1902.	Changes.
Imports	30,304	38,598	I. 8,294
Re-exports	5,604	4,992	D. 612
Net imports	24,700	33,606	I. 8,906
Ores and matte:			
Imports	87,826	167,141	I. 79,315
Re-exports	9,484	13,003	I. 4,200
Net imports	78,342	153,448	I. 75,106

The chief imports of fine copper were from Mexico, about 63 per cent of the total coming from that country. Next in order was Great Britain, which furnished about 29 per cent.

The report does not give ores and matte separately, which makes an exact statement of the contents difficult. Approximately, however, it may be said that net imports this year were equivalent to 64,060 long tons of fine copper.

Domestic exports for the 11 months included 150,010 tons fine copper and 17,104 tons ore and matte. Mr. John Stanton's statement, heretofore published, estimates the total exports at 158,021 tons fine copper.

Exports of copper from Atlantic ports in the week ending December 30 are reported by our special correspondents as follows: Great Britain, 425 long tons; Germany, 525; Holland, 609; France, 464; Austria, 498; Denmark, 60; Italy, 70; Russia, 285; China, 10; Japan, 1; Panama, 97; Brazil, 16; total, 3,150. Imports of copper were 422 tons from Great Britain, 101 tons from Japan and 625 tons from Mexico; total, 1,048 tons.

Tin.—In sympathy with the higher market for copper this metal was also very active throughout the week, and higher values have again been established. At the close we quote spot at 26 3/4c., futures at 26 7/8c.

The foreign market opened on Monday at £119 15s. advanced on Tuesday to £120 7s. 6d., and the closing quotations on Wednesday are cabled at £120 12s. 6d. @£120 15s. for spot, £121 5s. @£121 7s. 6d. for three months.

Imports of tin into the United States for the 11 months ending November 30 are reported as below, in long tons, of 2,240 lbs.:

	1901.	1902.	Changes.
Straits	17,648	18,003	I. 355
Australia	347	262	D. 85
Great Britain	11,140	14,633	I. 3,493
Holland	1,087	1,429	I. 342
Other countries	156	551	I. 395
Totals	30,378	34,878	I. 4,500

Nearly all the tin received from Great Britain is Straits tin, so that 93 per cent of our receipts in 1902 came from the Straits. The metal received from Holland is chiefly Banka tin.

Lead is dull and neglected. The ruling quotations are 3.95@4.05c., St. Louis; 4.05@4.10c., New York. The foreign market remains steady. Spanish lead being quoted at £10 15s. @£10 17s. 6d.; English lead, 2s. 6d. higher.

Imports of lead into the United States, with re-exports of imported lead, for the 11 months ending November 30, are reported by the Bureau of Statistics of the Treasury Department as below, in short tons of 2,000 lbs.:

	1901.	1902.	Changes.
Lead, metallic	595	2,329	I. 1,734
Lead in ores and base bullion	105,328	94,487	D. 10,841
Total imports	105,923	96,816	D. 9,107
Re-exports	90,710	71,274	D. 19,436
Balance	15,213	25,542	I. 10,329

Of the imports in 1902 84,346 tons, or 87.1 per cent of the total, were from Mexico, and 8,566 tons, or 8.8 per cent, from Canada. In addition to the re-exports given above there were 3,239 tons of domestic lead exported in 1902, against 2,366 tons in 1901.

Spelter has suffered a further decline, but the market has been quite active at the lower figures. The closing quotations are 4.37 1/2@4.40c., St. Louis; 4.55@4.57 1/2c., New York.

The foreign market remains firm, good ordinaries being quoted at £19 15s. @£19 17s. 6d.; specials, 5s. higher.

Exports of spelter, or metallic zinc, from the United States in the 11 months ending November 30, were 3,199 short tons, against 2,916 tons in the corresponding period of 1901; an increase of 283 tons, or 9.8 per cent. Exports of zinc ores were 45,037 tons in 1902, against 34,392 tons in 1901; an increase of 10,645 tons, or 30.9 per cent.

Antimony remains dull and depressed. We quote Cookson's at 8 1/4@8 1/2c.; Hallett's at 7@7 1/2c.; Hungarian, Italian, Japanese, French and U. S. Star at 6 1/4@6 7/8c.

Nickel.—The price is now quoted by leading producers at 40@75c. per lb., for large quantities down to ton lots, according to size and terms of order. The price for smaller lots, according to quality, runs as high as 60c. per lb.

Platinum.—Consumption continues good, and prices are firm. Ingot platinum in large lots brings \$19 per oz. in New York.

Chemical ware (crucibles and dishes), best hammered metal from store in large quantities, is worth 72 1/2c. per grain.

Quicksilver.—Prices continue unchanged. The New York quotation is \$48 per flask for large lots, with a slightly higher price for smaller quantities. The London quotation is £8 15s. per flask, with the same figure named from second hands. In San Francisco, prices continue at \$45.50@46.50 per flask for domestic orders, while for export \$43.50@44 is quoted.

Exports of quicksilver from all United States ports for the 11 months ending November 30 were 942,980 lbs., against 753,612 lbs. for the corresponding period in 1901; an increase of 189,368 lbs., or 25.1 per cent. The gain was chiefly due to large exports to China made in 1902.

Minor Metals and Alloys.—Wholesale prices, f. o. b. works, are as follows:

	Per lb.	Per lb.
Aluminum, No. 1, 90% ingots	33@37c.	
No. 2, 90% ingots	31@34c.	
Roller Sheets	4c. up	
Alum-bronze	20@22c.	
Nickel-alum	33@38c.	
Bismuth	1.50	
Chromium, pure (N. Y.)	80c.	
Copper, red oxide	50c.	
Ferro-Molyb'dum (50%)	1.25	
Ferro-Titanium (10%)	90c.	
Ferro-Titanium (20@25%, N. Y.)	85c.	
Ferro-Tungsten (87%)	2.50	
Magnesium	2.70	
Manganese, pure (N. Y.)	60c.	
Manganese Cop. (20% Mn)	32c.	
Manganese Cop. (50% Mn)	38c.	
Molybdenum (Best)	1.50	
Phosphorus	45c.	
American	70c.	
Sodium metal	50c.	
Tungsten (Best)	62c.	

MISSOURI ORE MARKET. Dec. 27.

(From Our Special Correspondent.)

The past week closed one of the most successful years in the history of Missouri-Kansas zinc and lead mining. The average price of zinc ore was \$6.12 over the average price of 1901, and the output of zinc ore exceeded that of 1901 by 4,239 tons. The lead ore output fell off 3,567 tons from that of 1901, but the average price was 11c. higher than during 1901. The average prices during 1902 were \$30.33 for zinc ore and \$46.10 for lead, as against \$24.21 for zinc ore and \$45.99 per ton for lead ore during 1901.

During the past week the zinc ore market was a little firmer. Already 500 tons of zinc ore have been loaded for export, and it is expected that fully 500 tons more will be loaded as soon as cars are provided. As to ore prices, it is pointed out that fluctuations may be attributed to the lack of cars in this district, which compelled the purchasing agents to buy sparingly and to insist upon a reduction when it was necessary to hold the ore for some time before it could be shipped. The holiday season is also a factor in the recent unsteadiness of the market.

The highest price paid for zinc ore during the week was \$35 per ton. This price was paid for only one lot, which assayed remarkably high. Several lots brought \$34.50, and the bulk of the high-grade ore brought \$33.50 and \$34 per ton. The assay basis ranged from \$30 to \$32 per ton for 60 per cent ore, with allowances for \$1 per ton for each unit of assay over 60 per cent. Lead ore brought \$25 per 1,000 lbs., without variation as to quality, and the entire production was purchased by the local concerns.

Following is the turn-in by camps of the Joplin District for week ending December 27:

	Zinc, lbs.	Lead, lbs.	Value.
Joplin	2,382,860	224,430	\$44,737
Galena-Empire	949,370	83,230	14,897
Carterville-Webb City	1,277,860	294,390	26,017
Duenweg	905,950	12,110	13,892
Oronogo	234,300	6,180	3,410
Cave Springs	133,970	1,170	1,971
Central City	133,840	9,100	1,767
Zincite	379,780	5,820	5,843
Aurora	705,060	7,160	9,344
Prosperity	250,110	9,690	3,994
Granby	230,000	12,500	2,512
Cartage	166,270	...	2,497
Neck and Alba	128,670	...	1,930
Carl Junction	192,780	...	3,985
Springfield	...	66,000	1,850
Gillam (Ark.)	106,010	...	1,160
Total	8,176,830	731,760	\$138,903
Total, 1902	525,090,880	63,230,840	\$9,430,790

Zinc value for week, \$119,556; lead, \$19,347; zinc value, 1902, \$7,973,660; lead, \$1,457,121.