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EVERY reader of this number of the ENGINEERING AND MINING JOURNAL should procure a copy bound in cloth, which can be obtained at this office, and keep it before him as an indispensable book of reference during the coming year.

THE English are securing many valuable properties in this country, and their investments of late have as a rule been much more rationally made than usual. As a result they are receiving large dividends, and have valuable property.

THE highest and best informed authorities in every part of the world have contributed, each in his specialty, to this issue of the ENGINEERING AND MINING JOURNAL. No such authoritative review of the mineral industry has ever before been published.

THERE have been no discoveries of great bonanzas, no mining "booms," during the year 1891, but the mining industry never was more prosperous and its prosperity never before was founded on so substantial a basis. Large investments have been made in mining, and for the most part with prudence. Under competent and honest management these investments are making highly satisfactory returns.

THE success of the work embodied in this issue is due not less to the untiring devotion of the members of the large staff of the ENGINEERING AND MINING JOURNAL than to the courteous co-operation of those interested in the production and marketing of the various minerals. Every demand for extra effort, involving the sacrifice of holidays, and nights as well as days, was accorded with uniform cheerfulness and the enthusiasm without which the accomplishment of such a work would be impossible.

THE great increase in the weight of the ENGINEERING AND MINING JOURNAL has for some time past made the foreign postage on it from 5 to 6 cents a copy, or averaging fully \$3 a year. It has become necessary to make the subscription price to foreign countries \$7 a year, to cover this extra postage. The subscription price of the JOURNAL has not been advanced, notwithstanding the great number of its pages, and the increase in its value, but remains at \$4 a year, for the United States, Canada and Mexico.

THE immense increase during 1891 in production of most of the metals has been a surprise. Copper in particular will, as usual, astonish the trade. The consumption of metals increases steadily, as might be expected from the growing wealth and prosperity of the country. Almost the only article which has fallen off has been steel rails, and with it pig iron. In this instance the financial condition of the railroads was the cause, while where consumption is made up of the purchases, in small and various forms by the people at large it steadily increases unless checked by very high prices. During the year 1891 prices were generally low and the people prosperous; they consequently purchased freely.

NOTHING more forcibly demonstrates the absurdity of our barbarous system of weights and measures than the compilation of statistics. We have tons of 2,240 pounds, of 2,000 pounds and the metric ton of 2,204½ pounds, or 1,000 kilos, to say nothing of the other special tons used in certain industries. We have ounces troy and avoirdupois, and grains and grams, with innumerable other weights. It is indeed high time that all civilized countries adopt the single metric standard of weights and measures—in which case the statistics compiled in one country will be available for comparison elsewhere without necessitating the laborious recalculation from one system into the other.

THE dividends declared by mining companies during the year 1891 were much greater than for many years past, and represent a better return on the money actually invested than ever before in the history of mining in this country. Our table of dividends shows but a small part of the earnings made, or even of the dividends actually made, for many of the most profitable mines are owned by close corporations, or by individuals who make no public returns of the earnings. It is greatly to be regretted that all companies do not publish frequent periodical returns of the work done at the mines and of receipts and expenditures. Nothing else would conduce more to economy, good management and large dividends than a strict adherence to this business-like requirement.

FOR the information of those who are not familiar with the paper, it is well to say that this number of the ENGINEERING AND MINING JOURNAL being wholly devoted to mineral statistics, the important departments of the weekly review of the markets for Coal, Metals, Chemicals and Stocks

etc., are omitted, as is also that of "Mining News," which in the regular issue occupies about five pages, and gives a condensed summary of mining information from every part of the world. The "Personal" column, which tells of the doings of engineers and others connected with the industry; the "Industrial Notes," which epitomize the work of manufacturers, and several other departments of great practical value and of general interest, are omitted from this issue, but will in future issues receive the attention and due proportion of space their importance deserves.

WE are indebted to the courtesy of Dr. DAVID T. DAY, Chief of the Division of Mining Statistics and Technology of the United States Geological Survey, for a statement, in advance of publication, of the statistics of the United States mineral production in 1889 and 1890. The figures for 1889 are those collected for the Eleventh Census, with a few unimportant exceptions.

These valuable statistics have reached us only as we are going to press, and fearing they would not be obtainable in time for this issue the ENGINEERING AND MINING JOURNAL, in collecting the statistics for the year 1891, secured also those for 1890 in order to check the figures published by us a year ago. This independent investigation has led us to question the accuracy of some of these Government returns. Thus the production of phosphate rock is given as 510,499 tons of 2,240 pounds in 1890, while our returns give a little more than this amount from South Carolina alone, and nearly 100,000 tons in addition from Florida. Our returns of the production of salt, aluminum, copper, lead and zinc, also greatly exceed those of the Government report.

While a very great part of the value of statistics of an industry lies in the promptness with which they are made available, still all accurate statistics have a historical value which is greater in proportion, as they are more reliable, and as no other and better figures are obtainable.

The collection of the full and accurate returns from a continent is no small undertaking, and it is proper that the government both of the United States and of the several states should collect returns from their respective territory, and promptly publish them for the benefit of the industry and the guidance of trade. For some years past the collection of the mineral statistics of the United States has been made with creditable accuracy on the whole, but with great dilatoriness, by the "Division of Mining Statistics and Technology" of the Geological Survey, and though the figures for the year 1890 have not yet been published elsewhere, we are, through the courtesy of Dr. DAVID T. DAY, the chief of this division, enabled to give them in this issue of the ENGINEERING AND MINING JOURNAL, in which are also printed the statistics for the year 1891.

No one will question the great value of the Government reports, as a whole, but in some particulars the work which the ENGINEERING AND MINING JOURNAL is doing has shown that the collection of the Government statistics of some of the minerals and metals has not been made with that care which is absolutely essential to give value to work of this kind. We have called attention elsewhere to discrepancies and inaccuracies, some of them quite important, in the figures of production of phosphate rock, of salt, of copper and lead, of aluminum, and a few less important items. We mention this here not in the spirit of fault finding, but in the hope that greater care will be taken in future to make these statistics accurate, and thus render them valuable to the student. The commercial demands of the mineral industry are fully supplied by the prompt publication of the statistics collected by the ENGINEERING AND MINING JOURNAL, so that the tardiness of the appearance of the Government figures is not so important as it otherwise might be.

IN this issue the ENGINEERING AND MINING JOURNAL surpasses all its own previous unrivaled records and presents the official returns of production during 1890 and 1891 of nearly all the important minerals and metals, and a comprehensive statement of the sources of production, the occurrence of the minerals, the uses and values of their products, and in many cases the stocks of metal on hand at the close of the year.

These statistics have been compiled with the greatest possible care, neither labor nor expense being spared to secure accuracy in every particular. Each producer has not only furnished the figures for the current year, 1891, in which the output for a portion of the month of December had necessarily to be estimated, but each has corrected his returns for the year 1890, thus checking our statistics for that year.

The statistical reports given in this issue of the ENGINEERING AND MINING JOURNAL, if published in octavo book form and in type similar to that used in the volumes of the "Mineral Resources" of the United States Geological Survey, would form a book of about 450 pages, while the advertisements would form a similar volume of 700 pages. That a volume of this kind, filled with statistics collected in great part by the use of the telegraph from all parts of the world, could be published as the regular issue of a weekly periodical is a great undertaking, but the really marvelous feature of it is that it has been possible for private enterprise to collect and pub-

lish within a few days of the close of the year the statistics of an industry not alone of a continent, but almost of the entire world.

It is not too much to say that a great part of the world now appreciates and applauds the great work done by the ENGINEERING AND MINING JOURNAL in collecting in the last days of every year the mineral statistics of a continent, and in publishing, the first day of the New Year, these full and accurate official returns of production and of stocks on hand, and full reviews of the markets for nearly all the useful minerals and metals. It is certainly very pleasant to have this work recognized as altogether without parallel in modern technical journalism, but assuredly the most agreeable testimony to its value, and to the honorable manner in which the work is done, is that given by those who so frankly and courteously furnish us with the confidential details of their business, because this information is necessary to us to prevent duplication in returns and in ascertaining the actual stocks of unconsumed metal in the country. At first there was a very natural reluctance on the part of some producers and dealers to give this information, a misuse of which might very injuriously affect their business, and we believe that in no other country in the world would it have been possible for a private individual or a newspaper to have obtained it. Americans are more liberal than others in communicating such information, and the ENGINEERING AND MINING JOURNAL was an old and tried friend to nearly every one engaged in the industry. Most of the important producers furnished the desired information the first year these statistics were compiled. Since then the value of the work itself became more and more widely recognized and the confidence of the few extended to all, until now, with scarcely an exception in any branch of the mineral industry, every one applied to gives with never failing courtesy the desired information, though so doing involves much labor and inconvenience at the busiest season of the year. It is through this unflinching courtesy alone that we are enabled to accomplish the great work. To those who have thus assisted us we tender our warmest thanks.

We now have to include in this list a rapidly increasing number in foreign lands. Many of the great producers, in nearly every foreign country, now furnish us with the information we seek; and while we are not yet able to make this statistical report cover the mineral industry of the whole world, we appear to be approaching by rapid strides the day when we can secure official reports covering the industry in every portion of the globe.

THE ENGINEERING AND MINING JOURNAL with this number enters its 53d volume, or its 27th year. While it is one of the oldest of the American technical periodicals, in the comparatively brief period since its establishment it has seen, and very largely contributed to, the creation of the greatest mineral industry the world has yet witnessed. Commencing under the many disadvantages of high wages, costly and unsuitable machinery and supplies, difficult and expensive transportation from the mines to the always distant markets, inexperience in the treatment of ores, which often differed widely from the familiar types known in the German and English metallurgical works, with few trained mining engineers or metallurgists, and no schools of mines in which to educate them, the mineral industry of the United States twenty-seven years ago was in its trying infancy. Its gold production, which was for the most part obtained by primitive methods from the rich gravels of California, had reached a value of \$53,225,000. Silver, which, though a far more abundant metal, requires a higher metallurgical knowledge for its extraction, was produced to the value of but \$11,250,000. The native copper of the Lake Superior mines had long attracted the attention of the world, and distinguished experts from Europe had lent their aid in the development of these mines, nevertheless the total output of copper of the United States had then scarcely attained 20,000,000 pounds a year, or less than one-third the present output of the Calumet & Hecla, or the Anaconda mines.

Our production of lead was but 14,700 tons of 2,000 lbs., and that of the minor metals was altogether insignificant. The pig iron make amounted to 931,582 tons of 2,000 lbs., while the output of anthracite coal was only 10,783,032.

The statistics of only a few of the articles were then collected, and that by private enterprise, for the interest of the people and of the Government was not enlisted in the industry.

With the establishment of the ENGINEERING AND MINING JOURNAL the mineral industry acquired its most potent ally. Through these columns the mining and metallurgical experience of the world were made available to those engaged in the industry, the defective methods were pointed out, the most successful practice and the teachings of science were advocated. The investment of capital in mines quickly followed the knowledge of the enormous mineral riches of the country; roads were constructed, mills and smelting establishments were erected as the JOURNAL recorded the fabulous profits realized from the great bonanzas, and steadier returns of the smaller mines made profitable by the adoption

of better methods of mining and metallurgy. The record of the triumph of American skill and ingenuity in the successful solution of new and difficult problems turned the eyes of all other parts of the world to this favored land, until now in mining and metallurgy American practice is universally admitted to be the best, and especially the best for countries developing their mineral industry under conditions resembling those here; and American experts, machinery and appliances are now sought for in every part of the world.

The mineral industry of the United States has grown from the modest proportions of twenty-seven years ago to the point where its products are now valued at about \$1,000,000,000 a year. It is not surprising, therefore, that those who have brought about this marvelous progress and who have attained unparalleled success should indeed be the most skillful men living in the practice of their arts.

The ENGINEERING AND MINING JOURNAL has always been one of the most important factors in the development of this great industry, and it has grown *pari passu* with it. Furnishing reliable information concerning everything new or of value in mining, metallurgy and general engineering, concerning the manufacturing and marketing of mineral products, it naturally was recognized at once as the American exponent of these arts, and became a "household word" with all those interested in the mineral industry in this country. Now that American practice is recognized as superior to all others, the ENGINEERING AND MINING JOURNAL is taken and consulted in every part of the world.

The mission of the ENGINEERING AND MINING JOURNAL is to promote the economical production of the useful minerals and metals and the safety and welfare of those engaged in this industry, and it effects these ends by promptly placing at the command of all those engaged in this industry all that is new and of value to them. It brings through its columns occupation to those seeking it, and finds labor for the mines and works through the information it gives. It secures profitable investment for capital and promotes the development of the industry by interesting capital in it. The uses and markets for mineral products and other information having a practical money value to a vast number of people; in a word everything that can promote the prosperity of the mineral industry is discussed in the ENGINEERING AND MINING JOURNAL in a manner to interest the general reader as well as the expert. Consequently the paper has grown with the industry it represents and the present issue is twenty times as large as that in which it first made its appearance. The appreciation of its usefulness to many branches of industry is well shown in the vast amount of advertising which it receives.

THE MINERAL PRODUCTION IN 1891.

The mineral industry of the United States grows apace. In 1890 the value of its chief items at the place of production exceeded \$650,000,000, and though the cash value of these products in 1891 was probably less than in 1890 owing to the lower market prices of most of them, yet the quantities produced were, with very few exceptions, much greater than in any previous year.

The output of gold is increasing, but in the absence of full returns we place it in 1891 at approximately 1,620,000 ounces, or \$33,250,000, an increase of 312,000 ounces.

The output of silver has increased much more rapidly, and we estimate, in the absence of full returns, that it amounted in 1891 to 58,000,000 ounces, the coining value of which would be \$74,820,000.

The coal consumption is generally considered to be the best measure of the industrial activity of a country. This rule would hold good for this country during the past year, when general industry was active and prosperous, though a few branches suffered a reaction. We find that the output of anthracite, of which we have full and accurate returns, amounted in 1891 to 42,839,779 tons of 2,240 pounds, while the production of bituminous coal, which is in part estimated, amounted to 98,000,000 tons. Prices of coal were, in general, lower than in 1890, though the anthracite trade, being "regulated," maintained during a portion of the year rather higher prices than in the previous year.

The iron industry suffered a severe "set back" during the past year, when the make of pig iron declined from 10,307,028 tons of 2,000 pounds, in 1890, to 8,976,000 in 1891, these figures being obtained from official returns made throughout the year. This heavy falling off was caused chiefly by the decline in the make of steel rails from 2,095,996 tons of 2,240 pounds in 1890 to 1,090,000 tons in 1891—a decline due partly to the poverty of the railroads and partly to the comparatively high price established by the steel rail association.

In phosphate rock, in pyrites, in salt, in aluminum, in copper, lead and zinc there has been a very considerable increase in output, while tin, antimony ore and sulphur enter the list with modest but promising beginnings.

The figures of the entire list except those of gold, silver and bituminous coal which are in part estimated have been collected from official returns in nearly every case and can be accepted as worthy of confidence, and they show the enormous development of this great industry. Never

before in the history of this country, of the world in fact, was mining on so satisfactory a basis. The increase in knowledge both as regards mineral deposits and the treatment of ores has eliminated much of the risk that formerly characterized mining operations, while the publicity given to frauds and swindling has prevented the realization of many nefarious schemes, and has put investors on their guard. Mining is becoming every year a more legitimate and profitable industry. The precautions necessary in placing money in other investments is now being observed in mining with the most beneficial results. There has been no mining boom for several years, and mining has been the gainer for it.

In the following table we have summarized the statistics of the production in the United States of the most important mineral substances for the years 1890 and 1891. The details of each industry will be found in proper place in the subsequent pages. No figures are given for the output of tin, antimony ore and sulphur in 1890. There was no tin produced in that year, and the outturn of antimony ore and sulphur was insignificant, amounting to less than 100 tons in each case.

MINERAL PRODUCTION OF THE UNITED STATES IN 1890 AND 1891.

	1890.	1891.
Gold, ounces.....	1,588,880	1,620,000
Silver, ounces.....	54,500,000	58,000,000
Pig Iron, tons of 2,000 lbs.....	10,307,028	8,976,000
Steel Rails, tons of 2,240 lbs.....	2,035,996	1,090,000
Copper, lbs.....	264,920,000	292,620,000
Lead, tons of 2,000 lbs.....	181,494	205,488
Zinc, tons of 2,000 lbs.....	66,342	76,500
Nickel, lbs.....	200,332	144,841
Quicksilver, flasks.....	22,926	21,022
Aluminum, lbs.....	94,881	163,820
Tin, lbs.....	.....	123,366
Antimony Ore, tons of 2,240 lbs.....	.....	700
Anthracite Coal, tons of 2,240 lbs.....	38,006,483	42,839,739
Bituminous Coal, tons of 2,240 lbs.....	93,000,000	98,000,000
Phosphate Rock, tons of 2,000 lbs.....	637,000	659,731
Salt, bbls. of 280 lbs.....	3,727,087	10,225,091
Bromine, lbs.....	310,000	415,000
Pyrites, tons of 2,000 lbs.....	109,431	122,438
Sulphur, tons of 2,000 lbs.....	.....	1,200

THE OPERATION OF THE UNITED STATES MINING LAW.

By Dr. E. W. Raymond.

There has been little litigation under the United States Mining Law during the past year of a character likely to settle points in its construction still undetermined. Some cases in the lower courts have brought out ingenious theories from the bench; but these are scarcely worth discussing while they remain without higher authority. The only important cases of the year in the Supreme Court involving new constructions of the Revised Statutes are three of the Iron Silver Mining Company's suits, namely, the two "Mike and Starr" cases and the "Sullivan" case. These had all been argued, and the decision was pending, more than a year ago. It is reported (how correctly I do not know) that the late Justice Miller was engaged in preparing the opinion of the Court. At all events, after his death the Court spontaneously ordered a rehearing, in which the three cases should be argued as one, with the help of illustrative diagrams, maps, and models; and counsel were requested to discuss particularly seven questions stated by the Court in its order. Of these, the following have a very wide application, and I therefore quote them here, omitting the other two, which turn upon the evidence peculiar to the cases at bar only:

1. What constitutes a "lode or vein" within the meaning of sections 2,320 and 2,333 of the Revised Statutes?
2. What constitutes a "known lode or vein" within the meaning of Section 2,333?
3. In what manner must the existence of such lode or vein be indicated, to enable the applicant for a placer patent to describe it, and tender the price for it per acre required by the Government?
4. Whether the existence of such lode or vein must be known, and its purchase applied for when the application is made for the placer patent, and whether a lode or vein will be excluded from the patent which is discovered after such application, and before the patent is issued?

The fourth of these questions has been decided by the Supreme Court already, in *Co. vs. Reynolds*, 116 U. S., 687, and 124 U. S., 374. And with regard to the first three, it must be admitted that the Court has, in sundry decisions, indirectly indicated or approached an answer. The issuance of the above order, therefore, must be taken as a sign that the Court desires to have them all thoroughly reconsidered and fairly met. It is, indeed, almost a tacit pledge that these important points will be deliberately decided by the highest authority.

The rehearing thus ordered took place in Washington, November 20th and 23d. The oral arguments were made for the Iron Silver Mining Company by Messrs. L. S. Dixon, of Denver, and Ashley Pond, of Detroit, and for the opposing parties by Mr. Thomas Patterson, of Denver. Pending the announcement of the decision of the Court, which is awaited with deep interest by a circle much wider than that of the immediate parties, I shall not comment upon the argument. On some future occasion I may be able to explain, in the light of the ascertained result of these cases, the relations of placer and lode locators as fixed by the statute.

This matter of the "known lode" once definitely settled, there will remain for final adjudication the principles involved in the "side line" and "end line" provisions of the law. There are conflicts seething in the lower courts which involve these principles, and sooner or later we may expect some case, clearly presenting them, to reach the U. S. Supreme Court, and receive an authoritative interpretation there. When that shall have happened, we shall at least know what the law is in the main. Perhaps, even before that time, we shall have become wise enough to abolish it and to substitute the simple system under which the rest of the world manages to live and to mine in peace and comfort. But of course no such beneficent reform will cut off the vested rights which have grown up since 1866 or 1872, and the venerable justices at Washington will

probably not escape the necessity of interpreting the present law, even after it has ceased to exist.

Meanwhile, the real miners in the West go on doing their best to comply with the statute, and settling innumerable controversies by compromise rather than by litigation. Buying out opponents is demoralizing and expensive, but it seems to be deemed by many proprietors simpler and cheaper than fighting. In one way or the other the owner of a valuable mine under the present United States law is pretty sure to be severely taxed, and there can be no doubt that the result has been to handicap heavily the industry which can least bear additional risks and burdens.

Perhaps the most important question now pending with relation to the mineral lands at present or lately in the public domain is one which does not fall under what is usually deemed the mining law proper. I mean the question of the title of the Northern Pacific Railroad and other land holders under similar conditions to land granted as agricultural, but really valuable for mineral deposits. It is impossible for me to state this issue fully in the present article. Still less shall I attempt to discuss it. But the following rough and incomplete outline of it may serve to introduce the practical comment which I desire to make.

Certain Acts of Congress provide for the survey of the public lands, excepting the mineral lands, and for the grant of the surveyed lands to the various classes of occupants or purchasers, such as homestead settlers, holders of land warrants, buyers at public sale, railroad companies, or sovereign States. In all these acts mineral lands are excepted, and separate statutes provide for the disposition of such lands, including coal and salines.

The surveyors of the Government survey and report as agricultural lands certain tracts, which are carried upon the maps of the Land Office in accordance with that classification, and are subsequently granted by the Government under the agricultural land laws supposed to apply to them. Can any subsequent discovery that such tracts are really mineral in character defeat or impair the title of the grantees? I think this question has been thoroughly and properly settled, by a long line of decisions, in the negative.

But suppose it can be proved that the tracts in question were evidently mineral and not agricultural at the time of survey, and that they were entered as agricultural by an error or a fraud on the part of the deputy surveyor, or of the office employing him, so that they are clearly such lands as the agricultural acts exclude, and the Land Department never had any right to grant them away as it did. On that hypothesis, I still think it clear that unless fraud can be brought home to the grantees, the Government is bound by its grant. However, there is much to be said on both sides; and there is, perhaps, a great conflict coming in which the matter will be thoroughly ventilated. I will only say at this time that I do not see how one class of grantees of land under United States patents can be treated differently in this respect from other classes. The farmer and the homestead settler, it seems to me, must fare just as the railroad company does. At least the difference, if any there be, has not yet been pointed out, to my knowledge.

But the practical comment on this whole business goes to another point altogether—namely, the silly and stupid system of government surveys, one principal cause of which has been the mining law. Every year a lot of surveying is let by contract to deputies of all degrees of ability. The work is usually done very badly. The monuments soon disappear, the lines fail to connect, the maps are wrong. I know of a case in Montana in which the deputy surveyor sketched a stream in the wrong section. A number of honest settlers along this stream proceeded to buy their homesteads from the United States, only to discover subsequently that they had bought land miles away in the desert. But this evil is not the one to which I wish to call attention now. I mention it, as affording a hint of the quality of the work which contract surveyors are likely to do.

Now, such lowest bidders for the work are informed that they will not be paid for surveying mineral lands; and therefore it is made their interest to report a given tract as agricultural, provided only it is not so rough and precipitous that they could not even pretend to survey it and make any money on the job at the competitive rates they have accepted. It is not surprising that they should make "agricultural" surveys wherever the ground is easy, unless there be some stalwart miner already in possession to warn them off. Yet it may turn out that their almost irresponsible decisions bind the Government.

Who is to blame for this? Congress, and rings, and the mining communities themselves; these last, I think, most of all; for Congress and the rings would have extended at least the miserable contract system over the mineral lands, and got them surveyed somehow, only the mining community wanted the privilege of laying out lode locations, etc., in all directions and dimensions, without being hampered by township and section lines. Consequently, Government surveys of mining claims are not made until the claimant applies for them and pays for them. Then they are not made to adjoin previous mineral surveys unless the claimant so desires. The result is that the public mineral lands look like a piece of cloth from which the accommodating tailor has permitted every corner to select and cut out a piece to suit himself. Innumerable gores, selvages, and remnants, of no use to anybody but blackmailers, remain un-odd. The property of the United States has been simply slashed and shredded away under this insane system. And in order to perpetuate this condition of affairs, the contract surveyors have been permitted, year after year, to classify the public land, setting apart by their surveys the areas which could be sold in the old-fashioned, honest way, and those, on the other hand, which, being "mineral," must be reserved for fancy carving. If both classes had been regularly surveyed, some more skillful authority might have had jurisdiction to decide their character afterward. But, of course, after actually surveying the mineral lands the Government would have sold them, with boundaries conforming to its established lines, and possibly (O dreadful thought!) without the extra-lateral lode right. Thus, for the sake of holding on to this right as to a part of the mineral lands, the mining communities have permitted a system which, as now seems probable, has irrevocably taken large and valuable areas out of the official "mineral" category altogether.

The system of United States land surveys is thoroughly bad. If it ever was adequate, it long since ceased to be so. I shall rejoice if its unpleasant results arouse the people of the West to demand something better.

ALUMINUM.

By W. R. Ingalls, M. E.

Pure aluminum is a white metal with a decided bluish tint, which becomes more marked upon exposure. It melts at about 1,300° F., but becomes pasty at a temperature of about 1000° F., and loses its tensile strength and very much of its rigidity at a temperature of 400° to 500° F., although this loss of strength is only while the metal is kept at the high temperature. It does not volatilize at any temperature ordinarily produced by the combustion of carbon. After silver, copper and gold, it is the best conductor of both heat and electricity; taking the thermal conductivity of silver as 100, that of copper is 73.6 and annealed aluminum of 98.5% purity, 38.87; taking the electrical conductivity of silver as 100, that of copper is 90, and that of pure annealed aluminum about 50. Pure aluminum and commercial aluminum, with less than 0.2% iron, exhibit no appreciable polarity.

Aluminum is tough but lacks hardness and rigidity, although both these qualities may be increased by the addition of a small percentage of some other metal. Pure aluminum is a very malleable and ductile metal, standing third in the order of malleability, and seventh in ductility. Like silver and gold aluminum stiffens up remarkably in working, its hardness and tensile strength being increased, and its ductility and malleability decreased. It can be welded readily by electric welding apparatus, and can now be successfully soldered. It can be cast without difficulty in dry sand molds, the shrinkage being $\frac{1}{4}$ in. per foot, compared with $\frac{3}{8}$ in. per foot in the case of brass.

Contrary to popular opinion, aluminum is not a non-corrodible metal. It is acted upon by the atmosphere, especially by moist atmosphere, and more especially still by moist salt atmosphere, the metal becoming covered by a thin coating of oxide, which seems to protect it from further oxidation. It is not acted upon by steam, boiling water, carbonic acid, carbonic oxide, or sulphuretted hydrogen. It is soluble in hydrochloric acid, and M. Leroy has shown recently that it is acted upon by nitric and sulphuric acids uncontaminated by hydrochloric acid. Solutions of the caustic alkalis, chlorine, bromine, iodine, and fluorine rapidly corrode aluminum, and strong aqua ammonia has a slight solvent action upon it. Recent experiments by a German chemist, described in *Industrie-Blätter*, No. 48, 1891, show that aluminum is attacked by a large number of vegetable acids at ordinary temperatures.

The specific gravity of aluminum is from 2.56 to 2.70. It has about the same ultimate tensile strength as cast iron, but under compression is comparatively weak. Mr. A. E. Hunt gives the average results of many tests of aluminum of the composition—aluminum, 97% to 99%, silicon (graphitic), 0.1% to 1%, silicon (combined), 0.9% to 2.8%, iron, 0.04% to 0.2%—in the following table:

Tension tests.	Castings.	Sheet.	Wire.	Bars.
Elastic limit per sq. in. in lbs.	6,500	12,000	13,000 to 30,000	14,000
Ultimate strength per sq. in. in lbs.	15,000	24,000	30,000 to 60,000	28,000
Reduction of area	15%	35%	60%	40%

Compression tests (in cylinders with length twice the diameter) showed: Elastic limit per square inch, 3,500 lbs.; ultimate strength per square inch, 13,000 lbs. The modulus of elasticity of cast aluminum is about 11,000,000; cold drawn aluminum wire about 19,000,000; aluminum sheets about 13,000,000. Under transverse test pure aluminum is not a very rigid metal. An inch square bar of good cast iron, supported on knife edges 4 ft. 6 in. apart and loaded in the center will readily stand 500 lbs. without a deflection of over 2 in. A similar bar of aluminum would deflect over 2 in. with a weight of 250 lbs. Aluminum, alloyed with a few per cent. of impurities and cold rolled, or otherwise worked cold, can be made, however, nearly as strong and elastic and more rigid than mild steel.

Aluminum forms alloys with all the metals with the exception of lead, antimony and mercury, and many of these alloys have already been proved to be very useful. The useful alloys of aluminum, so far discovered, are all in two groups, one of aluminum with less than 15% of other metals, and the other of metals containing less than 15% of aluminum; in the former case the other metals imparting hardness and other useful qualities to the aluminum, and in the latter the aluminum giving useful qualities to the other metals.

Ores of Aluminum.—The minerals which constitute the ores of aluminum are the following: *Bauxite* ($Al_2O_3 \cdot H_2O$), soft and granular, with 50% to 70% alumina, and only a few per cent. of accidental impurities besides the water of hydration; *Corundum* (Al_2O_3), very hard and crystalline, of 3.9 specific gravity, with 93% alumina and ordinarily very free from impurities, but so hard and crystalline, and withal so valuable for other purposes, as not to be at present used as an aluminum ore; *Diaspore* ($Al_2O_3 \cdot H_2O$), hard and crystalline, of 3.4 specific gravity, with 64% to 85% alumina and ordinarily very pure; *Cryolite* ($Al_2F_6 \cdot 6NaF$) of 2.9 specific gravity, with 40% aluminum fluoride and 60% sodium fluoride; *Aluminate* ($Al_2SO_4 \cdot 9H_2O$), of 1.66 specific gravity, containing about 30% of alumina in a condition to be cheaply purified by solution, filtration and roasting; *Gibbsite* ($Al_2O_3 \cdot 3H_2O$), stalactitic, of 2.4 specific gravity, containing about 65% alumina.

Clays of various kinds contain a large percentage of alumina, but it is combined with silica and these are not, consequently, available as ores of aluminum at the present time. Silica is much more easily reduced than alumina and by all methods of reduction this large percentage of silica must be separated from the alumina before the reduction is commenced, else a large percentage of energy used in reduction will be wasted.

The ore of aluminum most used is bauxite, which occurs in great abundance in Tennessee, Virginia, North and South Carolina, Georgia, Alabama and Arkansas. The discovery of the mineral in the latter State is a comparatively recent development, having been announced by Dr. John C. Branner, State Geologist, in the early part of 1891. These deposits cover an area of 640 acres in Saline and Pulaski counties, and vary in thickness from a few feet to over 40 ft. Good bauxite used in the manufacture of aluminum is worth about \$10 per ton at Pittsburg. Another ore generally used in the manufacture of aluminum by the electric processes of the present time is cryolite, which is imported from Evigtok, near Arksut, Greenland, that being the only country in which this mineral is mined. The Evigtok mine is worked as a quarry and has been opened 450 ft. long, 150 ft. wide and 100 ft. deep, while diamond drills

have penetrated 150 ft. deeper and found cryolite all the way. The mine is located close to the water's edge in Arksut Fjord. The cryolite imported from Greenland sells for 7c. per lb. in New York in barrel lots. The only place in the United States where cryolite is known to exist is at Pike's Peak, Colo., but no workable deposits have yet been found there. Early in the past year it was reported that a large vein of the mineral had been found, and a 2-ton lot was actually shipped, but the results of the exploration did not, apparently, come up to expectations.

Method of Winning.—Aluminum is generally produced at the present time by one of the electric smelting methods, which have almost entirely superseded the old sodium process. During the past year the Aluminum Company, Limited, which had been operating large works at Oldbury, near Birmingham, England, with the Castner process, has been obliged to abandon the manufacture of aluminum on account of the competition of the electric processes, and is now devoting itself to the manufacture of sodium only. Of the electric processes there are now four, more or less similar, in use, viz.: the Cowles, Hall, Heroult and Minet.

The general method of purification of bauxite, preliminary to the reduction to aluminum, is to calcine it with just enough sodium carbonate to form sodium aluminate, the temperature being kept below the melting point, and the mass well stirred. The incinerated mass is ground, and leached with hot water, which dissolves the sodium aluminate and leaves behind the silica and iron. The solution of sodium aluminate is then filtered off and the alumina precipitated with carbonic acid gas, filtered, washed, and dried. The alumina is next dissolved in molten cryolite (fluoride of aluminum and sodium) in suitable pots and electrolyzed, the apparatus and the details of the operation varying with the different processes.

Production.—Aluminum was first made in any quantity in 1855, its value at that time being \$90 per pound; with improvements in the methods of manufacture the price was gradually reduced to \$4.86 (£1) in 1887, but the recent development of the industry dates only from 1889, when the Pittsburg Reduction Company placed aluminum made by the Hall process on the market at \$2 per pound. The Pittsburg Reduction Company commenced operations in November, 1888, the Cowles Electric Smelting and Aluminum Company being engaged at that time in the manufacture of aluminum alloys, but is now producing pure aluminum; these were the only companies producing pure aluminum in the United States in 1889, in which year the production amounted to 47,468 lbs., valued at \$97,335. The total production of aluminum in the world from 1860 to 1889 inclusive is estimated by Mr. R. L. Packard, Special Agent of the Eleventh Census, at 232,000 lbs.

PRODUCTION AND IMPORTS OF ALUMINUM IN THE UNITED STATES SINCE 1870.

Year.	Imports.		Year.	Production.		Imports.	
	Amount lbs.	Value.		Amount, lbs.	Value.	Amount, lbs.	Value.
1870.....		\$98'00	1881.....			\$517'10	6071'00
1871.....		341'00	1882.....			566'50	6495'00
1872.....			1883.....	1,000	875	426'25	5079'00
1873.....	2'00	2'00	1884.....	1,800	1,350	594'00	8416'00
1874.....	683'00	2,25'00	1885.....	3,400	2,500	439'00	4736'00
1875.....	434'60	1,355'00	1886.....		27,000	452'10	5369'00
1876.....	139'00	1,112'00	1887.....		74,905	1,200'00	1,2119'00
1877.....	131'00	1,531'00	1888.....	19,000	65,000	1,348'53	14,086'00
1878.....	251'00	2,978'00	1889.....	47,468	97,345	998'83	4,840'00
1879.....	284'44	3,423'00	1890.....	*94,881	189,762	2,051'00	7,032'00
1880.....	340'75	4,042'00	1891.....	*163,820	163,820	1,1625'05	14,073'00

* Partly estimated. † Fiscal years.

The principal producers of aluminum in Europe at the present time are the Cowles Syndicate Company, Limited, and the Metal Reduction Syndicate, Limited, of England, using the Cowles and Hall processes respectively, and the *Aluminum Industrie Actien Gesellschaft*, of Lauffen-Neuhausen, in Switzerland, which uses the Heroult process. In the United States are the Pittsburg Reduction Company, with works at Kensington, Pa., and the Cowles Electric Smelting and Aluminum Company, with works at Lockport, N. Y. The United States Aluminum Metal Company, which controls the Heroult patents in the United States, has a plant at Boonton, N. J., which was originally erected for demonstrating this process and has produced some metal, but has not been in regular operation. The Wilson Aluminum Company is now establishing works at Leakesville, N. C., for the application of a process invented by Thos. L. Wilson, and expects to be in operation early in the present year. Works are also being erected at St. Michel, Savoy, France, at which the Minet process will be used.

The production of aluminum and aluminum in alloys in the United States in 1890 was about 95,000 lbs. In 1891 there has been a noticeable increase, and the total output for the year may be set down as 163,820 lbs. The Cowles works have run steadily throughout the year, but the Pittsburg works were idle from April to November, during which time the plant was removed from Pittsburg to Kensington, Pa., this change having been made necessary by the failure of natural gas in Pittsburg. The new works were put in operation on Nov. 12.

Uses.—The demand for aluminum showed a great increase in 1891 over the preceding year, and from present indications this demand is likely to still further increase as new fields for the employment of the metal are constantly being found. At the present time aluminum is being largely used to replace German silver and high grade brass and for castings for very many purposes in light moving machinery and parts of apparatus where lightness is an important element. A large amount is also used in steel castings, aluminum now being regularly employed for this purpose in almost all the important steel foundries in the United States. It is the increase in demand from the foundrymen that has, perhaps, been the most marked during the past year. Pure aluminum is also making its way into a thousand and one uses that must eventually consume enormous quantities of it; as, for instance, canteens for soldiers, cartridge shells for smokeless powder, buckles and sword scabbards, and other military accoutrements; the German Government having purchased a considerable quantity of metal in the United States during the autumn for this purpose; wire for telegraph and telephone purposes, harness trimmings, surgical instruments and house-

hold utensils, for all of which uses it has demonstrated its fitness in unequivocal manner. "Aluminized zinc" (an alloy of aluminum and zinc) is being employed in brass making, affording sounder castings, increasing the strength, and giving a finer color to the brass. This "aluminized zinc" is also of advantage to the galvanizers. Aluminum bronze is coming into greater favor for wire and sheet purposes, and is now being successfully drawn and rolled by many mills which had heretofore pronounced it utterly impossible to either make it into sheets, wire or castings. Altogether there is promise that the year 1892 will surpass 1891 in the aluminum industry as 1891 has surpassed 1890.

Price.—The price of aluminum has been subject to great fluctuations during the year, owing to the competition and litigation between the Cowles Electric Smelting and Aluminum Company and the Pittsburg Reduction Company. At the beginning of the year the Pittsburg Company was offering the metal in lots over 1,000 lbs. at \$2 per lb. and in lots over 100 lbs. at \$2.50 per lb. The Cowles Company asked \$1 per lb. for aluminum contained in alloys. In January the latter company offered pure aluminum at \$1.25 per lb. In March the Pittsburg company reduced its price to \$1 per lb. for commercially pure aluminum, and 90c. per lb. for metal below 97% and above 90% fine; the Cowles Company followed with a similar reduction. In the next month, however, Judge Ricks, of the Northern District of Ohio, before whom the suit between the two companies was pending, ordered that the price of the metal should be fixed at \$1.50, or the price at which the Pittsburg Company was selling, and the Cowles Company obeyed the order, but immediately offered aluminum in alloys at 75c. per lb.

In the meanwhile the price of the metal abroad had fallen, having been sold by the *Aluminum Industrie Actien Gesellschaft*, the Aluminum Company, Limited, and the Metal Reduction Syndicate, Limited, at 81c. per lb. (for commercially pure aluminum in ton lots), while the Cowles Syndicate Company, Limited, was reported to have sold its metal in New York at 90c. per lb., a price which must have been equivalent to 73c. per lb. at the works in England. Later pure aluminum was said to have been sold in Germany at 68c. per lb.

On the first of August the price was further reduced in the United States to 50c. by the action of the Pittsburg company, the Cowles Company following suit. This great reduction was simply a *ruse de guerre*, and probably a small amount of the metal only was disposed of at this figure. In the latter part of September the price was raised to 75c. per lb. in ton lots and 90c. per lb. in small lots, at which figures it is now held. In November the Neuhausen company reduced its price in Germany to 50@60c. per lb.

ANTIMONY.

By Prof. J. F. Kemp, School of Mines, Columbia College, New York.

Ores of Antimony.—Although antimony occurs in several of the Western silver ores, such as gray copper and dark ruby silver, it is only produced in a commercial way from its own sulphide, stibnite. This mineral usually crystallizes in aggregates of needles, and bladed crystals. It has a shining steel gray color, is soft, being easily cut with a knife, but above all else it fuses readily in the flame of a candle and in this way can be at once identified. It yields when heated on charcoal before the blowpipe, dense white fumes of the oxide of antimony. The chemical formula of stibnite (called also antimonite and antimony glance) is Sb_2S_3 , and it contains antimony, 71.8%; sulphur, 28.2%. The natural oxide, senarmonite, a dense, heavy white mineral, has been found in one locality in Mexico, near the Arizona line, and various antimonial ochres sometimes occur in the upper parts of the deposits.

Occurrence.—Within the United States stibnite has been found in a number of places, all in the West, and some mining has been done at those subsequently mentioned. It also occurs at Fredericton, New Brunswick, and in Nova Scotia. Small amounts have reached the market from both these places in previous years, but practically none in 1891. Stibnite is found at San Emigdio, Kern County, Cal., where it is contained, with quartz gangue, in a vein in granite. The vein varies in thickness from a few inches to several feet, and has produced some ore which has been smelted to regulus and shipped to market. Several other small deposits occur in San Benito County, and elsewhere in California. Stibnite has also been discovered in Humboldt County, Nev., about 18 miles east of Lovelocks Station, on the Central Pacific Railway, and in Lander County, not far from Austin. The ore is in a quartz gangue. Some remarkable deposits occur in Iron County, Utah, as masses of radiating needles which follow the stratification planes of sandstone and fill the interstices of a conglomerate. No attempts to work these Utah mines have been successful. Stibnite is found in Sevier County, Ark., filling veins, with a quartz gangue, in sandstone, and attempts to mine it have been made. Some antimony ochres were found in the upper portion of the veins. Antimonial alloys are also obtained in purifying base bullion.

Several years ago an interesting deposit of the oxide, senarmonite was found in the Mexican province of Sonora, just south of the Arizona line, but the quantity did not prove great. The largest single foreign producer of antimony is Borneo, from which 1,000 to 2,000 tons are annually exported. Nearly all the European states afford annual amounts of 500 tons and less, and some is obtained from Algeria and Australia. Within the past two years great progress has been made in the development of the antimony mines in New South Wales, which have already become large producers. In 1889 the output of these mines was but 221.4 long tons, valued at £3,344, while in 1890 the production had increased to 1,026 long tons, valued at £20,240. Much of the New South Wales ore carries gold, and no satisfactory process for the recovery of the precious metal has yet been introduced there, otherwise the output of antimony ore in that Colony would doubtless show an even more remarkable increase. The Colony of New Zealand produced 515 tons of antimony ore in 1890, which were valued at £11,121.

Uses.—The great use of metallic antimony is as an ingredient in certain alloys, such as type metal, britannia ware, etc., its office being to give hardness and stiffness. The quantity employed is not great and the

market is limited. Smaller amounts are used in medicinal salts, such as tartar emetic.

Production in the United States.—Up to the present year the amount of antimony ore mined in the United States has been very small, the entire output, with the exception of a few tons mined in Arkansas in 1890, having come from the California mines, which have been worked in a desultory manner. Early in 1890 a small amount of antimony regulus was smelted in Arkansas, but the works soon had to be closed on account of insufficient ore supply, it is said. During the past year, however, antimony mining may be said to have become an established industry and the output of the metal, although still small, far exceeds that of any previous year.

Early in the year the Beulah and Genesee mines, located at Big Creek, in Lander County, Nev., not far from Austin, were sold to an English syndicate, which organized as the Big Creek Mining Company, Limited, with a capital of £50,000. Before the consummation of the sale the vendors of the property shipped 100 tons of ore to England, which averaged 65.25% antimony per ton. The Beulah mine then showed a vein of nearly pure stibnite, 3 ft. wide, apparently going down in full strength. From the time the new company took over the mines regular shipments have been made, the product for the year amounting in round numbers to 700 tons of ore, averaging 65% antimony, and realizing an average of £28 per ton in Liverpool. On October 14th the company paid a dividend of 1s. per share, amounting to \$12,500, and in December another of the same amount was declared. As the Beulah mine has been developed to greater depth the vein has widened, while the grade of the ore has been fully maintained. Frequently blocks of ore weighing 1,500 lbs., or 2,000 lbs., assaying 70% antimony, have been broken down, and one shipment to Liverpool averaged 69% antimony.

The Thies-Hutchens mines in Humboldt County, Nev., have also been operated during 1891, having been acquired in the early part of the year by a New York syndicate. These mines are located in the Black Knob district, about 15 miles from Lovelocks. They are opened to a considerable extent by shafts and tunnels which show a well defined vein. This company has produced about 400 tons of ore during the year, which, it is reported, will average 33% antimony, but has made no shipments, as it is proposed to reduce the ore at the mines, for which purpose furnaces are now being erected.

IMPORTS OF ANTIMONY INTO THE UNITED STATES.

Years.	Crude and regulus.		Ore.		Total value.
	Quantity. Pounds.	Value.	Quantity. Pounds.	Value.	
1885	2,579,840	\$207,215	215,913	\$7,497	\$214,712
1886	2,997,985	202,563	218,366	9,761	212,324
1887	2,553,284	169,747	362,761	8,785	178,532
1888	2,814,044	248,015	68,040	2,178	250,193
1889	2,676,130	304,711	140,309	5,568	310,279
1890	3,315,659	411,960	611,140	29,878	441,838

THE ANTIMONY MARKET IN 1891.

Prices for the greater part of the year were rather high, but nevertheless consumption has been larger and it appears to be still on the increase. We are sorry that the smelting industry of this metal has not made any progress in this country, and all the metal has to be imported from England.

The year opened with Cookson's at 18½@19c., and Hallett's at 16½@16¾c., and these prices continued steadily with not much variation until the end of April, when a weaker tendency became manifest; but prices declined only very slowly. Cookson's then sold at 16½c. and Hallett's at 14½c. and it was not until the middle of June that values gave way further to Cookson's 14½c., and Hallett's 13c.; from then on the decline made more rapid progress, the more so because smelters were all the time rather free sellers.

This action was in part due to exaggerated reports from Japan that large quantities of crude metal had accumulated and were being shipped to England as fast as they could be. In the face of these large supplies it was only natural that the smelters should make sales as fast as they took the raw material in, but in doing so the decline was carried too far, and by the end of August the metal had declined to 11½c. for Cookson's and to 10½c. for Hallett's, when a somewhat steadier tone set in. This was soon lost and the lowest prices were reached by the end of September, with Cookson's at 11½c. and Hallett's at 9½@9¾c. At this very large decline consumers entered the market very largely and contracted mostly for several months ahead.

On the other hand, the English smelters found that the raw material on which they were then depending was not forthcoming and a very pronounced change set in, which brought prices up very quickly to 16½c. for Cookson's and to 12½@12¾c. for Hallett's, which are the closing prices.

Beside the above, some inferior brands were imported in small quantities, and also regular consignments of L.X. arrived. This brand has now found its way into almost all type foundries in this country, and is considered almost equal to Cookson's, assaying very high in antimony with only small percentages of impurities. The price of this brand is usually held between that of Cookson's and Hallett's.

Stocks are light, present prices are considered cheap and lower prices are not anticipated.

AVERAGE MONTHLY PRICES OF ANTIMONY IN NEW YORK, IN CENTS PER POUND.

1891.	Jan.	Feb.	Mar.	Apl.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Cookson's.	19	18	17½	17½	16	14½	13½	12	11½	13½	16	16½	15½
Hallett's....	16½	16½	16	15½	14½	13	12	10½	10	11	12½	12½	13½
L. X.	17½	17	16½	16	15½	13½	12½	11½	10½	12	15½	15½	14½

THE LONDON ANTIMONY MARKET IN 1891.

(From our Special Correspondent.)

It will be remembered that the year 1889 witnessed the rapid rise of the article from £44 10s. to £75 10s. and that last year passed off very steadily at prices ranging between £77 10s. and £70.

The present year opened dull at £71 to £72 with demand almost stag-

nant and sales very difficult. The history of the market during the eight months, January to August, is one of a constant and rapid retrograde movement, due largely to lack of demand and partly, no doubt, to the considerable accumulations of Japanese crude antimony, which could not be cleared off for a long time owing to the divergence between the holders' idea of value and that of our smelters. By the end of August the value of regulars had declined to £39, and at this limit producers began to resist the fall. Dealers then became a little nervous and when they tried to buy they found that stocks were very small. Encouraged by dealers' purchases smelters began to buy ores, etc., and on their side found that the supply of raw material was small. They also made efforts to purchase the stock of Japan crude. It was, however, only after regulars had risen above £45 that the business in crude became possible, viz.: at about £22, London terms. The market then rose rapidly—rid of the incubus of the major part of the said stocks and stimulated by a good demand, especially from American—so that by the end of November the value had reached £55 to £58, at which we close in firm tendency, the principal English smelters having practically sold out for some two or three months ahead.

ASBESTOS.

Asbestos of inferior quality is found in a number of localities in the United States, but these have never become very important producers. Pelham, Mass., Staten Island, N. Y., various localities in the Southern States, and in Colorado and California have at one time and another received attention. The American mineral is only adapted to grinding up for paints and cements. The chief source of the fibrous asbestos, suitable for weaving, formerly was Italy, but since 1879 the Canadian mines near Thetford, Province of Quebec, just north of Vermont, have become the chief source. The mineral occurs in veins in serpentine with the fibers perpendicular to the walls. Four grades are made; No. 1 has fibers one inch long and upward, and sells now for \$170 or more per ton; No. 2 has fibers under one inch but still good for weaving; No. 3 has bits of gangue, etc., mixed with short fibers; and No. 4 is the waste material good only for grinding. The American market is principally supplied with the Canadian asbestos. The imports of the article into this country are shown in the following table:

IMPORTS OF ASBESTOS INTO THE UNITED STATES.

Years.*	Total.	Unmanufactured.	Manufactured.	Years.*	Total.	Unmanufactured.	Manufactured.
1869....	\$310	.....	\$310	1880....	\$9,736	\$9,736	.....
1870....	7	.....	7	1881....	27,786	27,717	\$69
1871....	12	.....	12	1882....	15,739	15,235	504
1872....	.....	.....	.....	1883....	24,612	24,369	243
1873....	18	\$18	.....	1884....	49,940	48,755	1,185
1874....	152	152	.....	1885....	73,643	73,026	617
1875....	5,733	4,706	1,027	1886....	135,125	134,193	932
1876....	5,381	5,435	396	1887....	140,845	140,264	581
1877....	3,221	1,671	1,550	1888....	176,710	168,584	8,126
1878....	3,903	3,536	372	1889....	263,393	254,259	9,134
1879....	7,828	3,204	4,624	1890....	†254,935	†249,989	†4,946

* Prior to 1885 the years are fiscal years ending June 30th; subsequently calendar years, unless otherwise specified. † Fiscal years.

ASPHALTUM.

By Prof. J. F. Kemp, School of Mines, Columbia College, New York.

Under the name of asphaltum are included those natural hydrocarbon minerals which are solid at ordinary temperatures, and which have been formed by the slow evaporation or inspissation of petroleum. They differ from coals and fossil gums, and are also distinguished from the mineral waxes which are elsewhere mentioned under ozokerite. Asphalts shade into viscous material by insensible gradations, and themselves owe their practical applications to their fusible and soluble properties. They form on the surface by slow distillation, or fill fissures or saturate porous rocks. They are thus commonly mingled with foreign materials, and are obtained in the pure state by melting and skimming, or by liqutation.

Asphalts are employed as a cementing material, as a waterproof coating, as an electrical insulator, as a basis of varnish or paint, and as an important ingredient in street pavements. These various uses depend on the physical properties of the particular variety, some being good for one, some for another. The tough varieties answer for paving, the more brittle are better adapted for varnish.

The asphalt most employed in the East comes from the island of Trinidad, where it forms a superficial deposit covering more than one hundred acres and extending to a depth of from 18 ft. at the sides to 78 ft. in the middle of the area. It is overlaid by blue clay and is perfectly hard on the surface. Cracks in it are filled with rain water and surface debris. The crude material contains about 40% pure asphalt, while the remainder consists of earthy and vegetable impurities and water. It is extensively imported into cities in the East and used for street paving in suitable mixtures with crushed rock. For this purpose, and for its other uses it is softened with oils of various kinds.

Several occurrences of asphalt filling fissure veins and forming a coal-like substance attracted much attention in the East, in earlier years. One from New Brunswick was called albertite, one from West Virginia, grahamite. They are brittle, jet-like materials and were used as gas enrichers. Of late years much interest has centered about deposits in Colorado and Utah. In northwestern Colorado, in the White River country, a black, brittle asphalt is found along the surveyed line of the Colorado Midland Railway near the Utah boundary. The Utah deposits in Uintah County, about 100 miles north of the Rio Grande Western Railroad, have become quite important producers, having shipped 1,500 tons in 1889. This asphaltum has been called both gilsonite and uintaite, and is a shining, brittle substance and a valuable ingredient in varnishes. Another asphaltum from Utah is wurtzilite, which has some physical properties in marked contrast with uintaite, although much resembling it in appearance. It is quite insoluble in the ordinary reagents. Asphaltum is also melted out of certain sandstones near the town of Thistle,

Utah. All of these deposits of asphalt are in rocks of Tertiary age which were formed in fresh water lakes.

Very large amounts of liquid asphaltum or brea, are obtained in Los Angeles and Ventura counties, California. This substance is rather a maltha or fluid hydrocarbon and is used for coating iron to prevent rust. True asphalt does occur, however, filling fissures in a siliceous clay in Ventura County and is in important quantity.

Rocks, either sandstones or limestones, are found in various parts of the country containing 10% or so of asphaltum, such that when crushed and warmed they can be tamped into paving, either with or without added oil. The Seyssel limestone from France and the similar one from Val-de-Travers, Switzerland, have been used in the United States. An asphaltic limestone from Kentucky is employed to some extent in Buffalo and others occur in Colorado and Utah. Asphaltic sandstones are extensively quarried in Southern California and furnish a very useful pavement. The principal deposits are south of San Luis Obispo, whence the rock is taken to the cities of the Pacific Coast.

PRODUCTION, IMPORTS AND EXPORTS OF ASPHALTUM.

Year.	Production.		Imports.		Exports.	
	Amount (tons).	Value.	Amount (tons).	Value.	Amount (tons).	Value.
1887.....	4,000	\$16,000	30,808	\$95,735	*66	\$3,288
1888.....	53,800	331,500	36,494	84,045	*66	3,589
1889.....	51,735	171,537	61,952	138,163	305	6,364
1890.....	40,841	193,416	73,345	223,891	*258	3,965

* Fiscal years ending June 30.

Asphaltum as a cementing material is employed in the linings of aqueducts and submarine tunnels. The bricks are first heated, then dipped in melted asphalt, and laid while hot in the cement. The uintaite or gilsonite of Utah furnishes an excellent body for coach varnishes, and to this purpose it is extensively applied. St. Louis works absorb the greater part of the output of the mines. A considerable quantity is also used for insulating electrical apparatus.

OZOKERITE.

The natural, solid hydrocarbons, with a structure resembling wax or paraffine, are called ozokerite. The principal source of such material is in the oil region of the Austrian province of Galicia, where the mineral occurs in a blue clay 150 ft. and more from the surface. Its occurrence in the San Pete Valley in Central Utah has been long known. It forms small veins and larger masses in sandstone. For many years it was regarded only as a curious and interesting mineral, but three years ago systematic explorations were undertaken by New York parties and deposits of commercial importance were opened up.

PRODUCTION AND IMPORTS OF OZOKERITE OR MINERAL WAX IN THE UNITED STATES.

Year.	Production.		Imports.	
	Amount, lbs.	Value.	Amount, lbs.	Value.
1886.....	.....	.....	800,496	\$71,220
1887.....	.....	.....	718,769	59,084
1888.....	65,000	\$2,500	1,164,940	89,131
1889.....	50,000	2,500	1,078,725	86,682
1890.....	300,000	15,000	.....	.....

Ozokerite has usually been considered as belonging to the paraffine series, but lately Dr. Wurtz has advanced the theory that it belongs with the olefines and that it has originated by polymeric change from petroleum. Its uses are numerous, as it is an admirable substitute for beeswax. It resists the action of many corrosive chemicals and is an excellent insulator for electrical conductors. The Austrian locality furnishes some sixty millions of pounds yearly. The American mineral is worth from 4 to 5 cents per pound in Utah, but brings 6 to 10 cents in New York.

PRODUCTION OF ASPHALTUM IN UTAH.

(From our Special Correspondent.)

The asphaltum output for Utah for the year 1890 consisted chiefly of the product of the Gilson Asphaltum Company, shipments being made by wagon from this company's mines near Ft. Duchesne on the Uintah Indian reservation 90 miles to Price, on the Rio Grande Western Railway; thence eastward for distribution throughout the United States. The shipments approximated 1 200 tons, valued at \$90.00 to \$100.00 in the markets of the East. This form of asphaltum is used almost exclusively for making varnishes. One thousand tons of bituminous sandstone were shipped by the North American Asphalt Company to Denver, St. Louis and other eastern cities in 1890, valued at \$20.00 per ton, delivered in the East.

During 1891 the operations of the Wasatch Asphaltum Company have attracted considerable attention. This company is engaged in producing asphaltic limestone from its mines in Spanish Fork Cañon on the line of the Rio Grande Western Railway and preparing it for use at its mills at Salt Lake City. The material is said to resemble that of Val de Travers, Switzerland, very closely, but to contain a higher percentage of asphaltum. The deposits are claimed to be of great extent. The asphaltic rock is ground without any preparation and is sold in bags as "Wasatch ground asphaltum," which can be laid as pavement without admixture by simply heating. For export purposes a grade known as "mastic" is used. This contains 35% asphaltum and is shipped in 50-lb. octagonal blocks about 2½ in. thick. For laying pavements this "mastic" is melted, and mixed with from 100% to 300% of clean sharp sand. It is said to contain no ingredients volatile under 300° F.

During the year 1891 the Gilson Asphaltum Company continued its shipments, aggregating for the year nearly 1,500 tons, the price being the same as in 1890. The Wasatch Asphaltum Company commenced shipments on the 1st of September, 1891, of the same kind of asphaltum, and up to the end of the year has sent out 400 tons. It has also shipped from its mines in Spanish Fork Cañon 800 tons of asphaltic limestone, valued at \$18, and 500 tons of mastic, valued at \$30 per ton, nearly all of which has gone to eastern cities for paving purposes. Some twenty tons, valued at \$15, have been produced by the Utah Asphaltum Company near Ashley, but shipments have not been continued because of the heavy cost of hauling the material 100 miles by wagon; 150 tons have been produced from various other fields of bituminous sandstone, at a valuation of \$15 per ton on board cars. There is every reason to expect that asphaltic rock for paving purposes will be mined in much larger quantities during the year '92.

BORAX.

By Prof. J. F. Kemp, School of Mines, Columbia College, New York.

The important minerals containing boracic acid which are actual commercial sources of this useful compound are borax or tinkal, $\text{Na}_2\text{O} \cdot 2\text{B}_2\text{O}_3 + 10\text{H}_2\text{O}$, which forms monoclinic crystals of prismatic habit, and sassolite, H_2BO_3 , which is commonly in solution and is obtained on evaporation. Calcium borate or ulexite is also a less important source, because the commercial product is the sodium borate and the ulexite requires extra treatment.

Occurrence.—Borax is produced in the United States only in Nevada and California. Its occurrence is chiefly in the region of the Great Basin in Western Nevada and Southern California, but a small pond was also formerly utilized on the shores of Clear Lake, some 80 miles north of San Francisco. The principal sources are now in Esmeralda County, Nev., and San Bernardino and Inyo Counties, Cal. Both these regions are characterized by alkaline deserts or marshes that are the dried bottoms of former lakes.

The best known and most important "salines," as these alkaline flats are called, are Teel's Marsh, Columbus Marsh, Fish Lake Valley and Rhodes Marsh, in Esmeralda County, Nev., all being in confined valleys whose drainage evaporates instead of running off. The surface is sometimes coated with a boracic efflorescence which works up from the main storage deposits below. These marshes cover many thousand acres, but have relatively limited rich portions which admit of profitable working. Considerable common salt, sodium sulphate, gypsum and other alkaline compounds are associated.

The Pacific Coast Borax Company, which is one of the most important producers of borax in the United States, operates in the Columbus Marsh, the Nevada Borax Company in Rhodes Marsh, and Smith Bros., in Teel's Marsh. In California the San Bernardino Borax Company works on the State Range Marsh, and the Amargosa Borax Company, about 100 miles northeast in Death Valley.

The small pond near Clear Lake obtained its supply from the waters issuing from a neighboring hot spring, as has been shown by Mr. G. F. Becker. The spring water was found to contain about 0.5% borax. The more southern deposits seem to obtain their supplies from the drainage of the neighboring heights. The chief foreign sources of borax are on the west coast of South America, in Chili, on the east coast in La Plata, in India, and in Tuscany. In the district last named the borax is obtained from hot springs in a region of expiring volcanic activity, and the waters are evaporated by steam from neighboring vents.

Preparation.—The sand, clay, etc., which contains the borax is dug up, allowed to dry and then taken to tanks, in which it is boiled in water and ixivated. The heat is usually imparted to the solutions by means of steam coils, and the fuel is such as can be obtained in the neighborhood. The water is obtained from artesian wells. After having been thoroughly leached the solution is settled and piped off into crystallizing vats, in which it cools and deposits the borax. These vats are commonly made of galvanized iron. If the crystals are dirty and impure, resolution and recrystallization may be necessary. Care is also taken to get all the borax of the original residues and not to let the solutions escape after crystallization until all the borax is out of them. The climate is excessively hot and in some regions difficulty is experienced in the summer months in gaining a low enough temperature to cause the crystals to form. In some marshes the borax occurs as finely formed crystals embedded in the clay and soil, but in general, it is in a too finely divided condition to be so apparent.

Uses.—The uses of borax are manifold, and have grown immensely of late years. The principal one is in welding, but large quantities are also employed as an antiseptic in packing meats, as an enamel, and as a flux in metallurgical operations and assaying. Seven million five hundred and eighty-nine thousand pounds were produced in 1888, worth on the average 6 cents per pound. Eleven million pounds was the output in 1887, but the price was 5 cents. New York and England are the chief markets.

BROMINE.

Bromine is an element closely allied to chlorine. It is not found in the free state in nature, but always in combination with some other element, as a bromide. At the ordinary temperature bromine is a liquid of dark brown-red color, about three times as heavy as water, and highly poisonous. It boils at about 60° C., but is very volatile even at the ordinary temperature of the air.

Occurrence.—Bromides occur in small quantities in sea water, and in the water of many saline springs. The brines produced in the salt regions of West Virginia, Pennsylvania, Midland County, Mich., and the Tuscarawas Valley and Pomeroy, Ohio, contain so large a proportion of bromides that it is profitable to save them and prepare bromine as a by-product, and all the bromine produced in the United States comes from these sources.

Production.—The production of bromide in 1891 was 415,000 lbs., divided as follows: Pennsylvania, 140,000 lbs.; Michigan, 45,000 lbs.; Ohio, 110,000 lbs.; West Virginia, 120,000 lbs. The production for the past nine years is shown in the following table:

PRODUCTION OF BROMINE IN THE UNITED STATES.

States.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Ohio.....	194,450	181,591	125,000	126,866	104,662	64,540	150,000	200,000	110,000
West Virginia..	166,650	99,509	85,000	126,391	16,425	61,609			
Pennsylvania..	.....	.....	60,000	49,549	78,000	100,113	60,000	70,000	140,000
Michigan.....	.....	.....	40,000	125,528	.....	81,124	40,000	40,000	45,000
Total.....	301,100	281,100	310,000	428,334	199,087	307,386	250,000	310,000	415,000

The output has been for several years and still remains somewhat in excess of consumption.

Manufacture.—The bromides in the brine from the salt wells are concentrated in the bittern during the process of salt manufacture. The

bittern, at a specific gravity ranging from 35° B. to 42° B., is treated with sulphuric acid and black oxide of manganese (pyrolusite), the amount of reagents used being dependent upon the percentage of bromides in the bittern. The sulphuric acid combines with the base of the bromide and forms hydrobromic acid; the latter is oxidized by the pyrolusite with the evolution of bromine gas, which is collected and condensed in suitable vessels.

Uses.—The manufacturing chemists are the principal consumers of bromine, using it in the preparation of bromides, chiefly potassium bromide. A small part of the product is used in the manufacture of eosine, an aniline color, and smaller amounts as a disinfectant. The use of bromine as a substitute for chlorine in the metallurgical treatment of gold ores has been proposed, but it has not, so far, been employed for this purpose to an important extent.

Price.—Until March of this year there existed an agreement between the National Bromine Company, which comprised most of the manufacturers of this country, and the German producers, to limit their sales to the United States and Europe respectively; the National Bromine Company also had an understanding with some of the largest consumers of this country concerning the sale of the product controlled by it. Up to this time the price of bromine had been nominally 32c. per lb., delivered. In March the contracts between the consumers and the National Bromine Company expired, and the latter, being unable to renew them, dissolved; the compact with the German producers was of course terminated thereby. The stocks which had accumulated in the United States were then offered for shipment abroad, and parcels were sold in England, France and Germany at reduced prices. This move on the part of the Americans brought about a retaliation from the German makers, who sent bromine as well as bromides to this country, and made sales at prices lower than any before quoted in this market. The lowest point reached for bromine was 17½c. per lb., at which figure it is still quoted, but not much is being sold.

When the importations from Germany commenced it was, at first, liquid bromine, which found its way into this country, but later, as the difficulty of obtaining freight for this article increased, the imports were made chiefly in the form of bromides, notwithstanding that the duty on these salts is 25% ad valorem. This state of affairs continues at the close of the year, and quotations remain 17½c. per lb. for German bromine, and 21½c. per lb. for potassium bromide, delivered at New York, duty paid. It is probable, however, that the competing parties have now spent their force, and that developments may take place soon, and that will restore the industry to its former basis. The price actually realized by the National Bromine Company, before it dissolved, was about 23c. per lb.

CHROMIUM.

By J. F. Kemp, School of Mines, Columbia College, New York.

Chromium is not employed in the metallic state, but it enters into some important chemical reagents and pigments, and gives great hardness to steel.

Source.—The mineral chromite, which is a mixture of the oxide of iron and chromium, is the universal source of chromium. Chromite is a member of the spinel series, and resembles magnetite very closely. It is black in color, metallic in luster, but it is not attracted by a magnet like magnetite, and also on a hard white surface will make a brown mark or streak instead of a black one, as is the case with magnetite. When fused before the blowpipe with borax on a platinum wire it yields an emerald green head that is very characteristic. The theoretical chromite $\text{FeO} \cdot \text{Cr}_2\text{O}_3$, with a percentage of chromic oxide of 68, often has magnesia, MgO , replacing a portion of the FeO , and ferric oxide, Fe_2O_3 , and alumina Al_2O_3 , replacing a part of the Cr_2O_3 . These other oxides lower the grade of the ore. About 50% chromic oxide is the general market standard.

Occurrence.—Chromite is always found in association with serpentine. This rock has usually resulted from the alteration of rocks, consisting largely of olivine, hornblende and pyroxene; the chromic oxide has separated from these minerals and from a chrome spinel (picotite, $\text{MgO} \cdot \text{FeO} \cdot \text{Al}_2\text{O}_3 \cdot \text{Fe}_2\text{O}_3 \cdot \text{Cr}_2\text{O}_3$) often found with them. The chromite is thus scattered through the serpentine in irregular masses, which are often of considerable size. Although known as a mineral in many serpentines, chromite has only been produced commercially in Southeastern Pennsylvania and the adjacent portions of Maryland and on the Pacific Coast. Large quantities were obtained in the East in earlier years and led to the establishment of the great works of the Tysons at Baltimore, and this section continues to be the center of American manufacture.

Individual mines are seldom large on account of the pockety nature of the deposit. Wood's mine, in Lancaster County, Penn., was a notable exception, but it is now exhausted. Certain others in the Bare Hills north of Baltimore were also quite productive in their day. California is at present the principal commercial source of chrome ore in the United States. Great areas of serpentine occur on the flanks of the Sierras and in the Coast Range. These afford chromite in Del Norte, San Luis Obispo, Placer, Shasta, and many other counties of the State, but the four named send the greater portion to market. A mine on Shotgun Creek, in Shasta County, produced in 1889 the exceptional yield of 2,000 tons; the general yield is much less. In San Luis Obispo County the mineral is gathered from the surface of the serpentine, where it has been left as "float" by the weathering of the rock. It is also mined underground. At the shipping point an ore with 50% chrome oxide brought \$8 per ton. It all went to Baltimore, and cost at the works about \$22.50 per ton. Imported Scotch ore costs \$25 per ton. No ore less than 47% chromic oxide is accepted, at present conditions, but ores over 50% bring higher prices. There is great uncertainty in the mining on account of the irregular distribution of the ore, and because it grows less rich as depth is attained. Traces of nickel minerals frequently occur in connection with chrome ore.

The principal foreign source of chromium is Asia Minor. Considerable quantities are exported from New Zealand, New Caledonia, Queensland and Russia.

Uses.—The great use of chromite is the manufacture of bichromate of potash, a salt that is very extensively employed in calico printing. It is also a basis for many pigments, such as chrome yellow, chrome orange,

chrome green, and considerable quantities enter into the construction of some forms of electric batteries. Both the bichromate and the chromate of potash are important chemical reagents. The corresponding salts of soda have been introduced in the last five years quite extensively. A relatively small proportion of the chromite mined enters into the production of chrome steel. As contrasted with common steel, this has great hardness, and is valuable for cutting tools, for stamp shoes and dies, for safes, etc. It is chiefly made in Brooklyn.

Product m.—Baltimore is the great center of the American bichromate manufacture. The firm of Jesse Tyson & Sons for many years had a monopoly of the business. Their process is a secret one. Within the last few years, however, the salt has been also produced at the Kalion Works, in Philadelphia. Large amounts of bichromate are annually imported in addition to the local product.

PRODUCTION, IMPORTS AND EXPORTS OF CHROMIUM COMPOUNDS.

Year*	Production.		Imports.				Exports.	
	Chromic ore. Long tons.	Value in California	Chromate and bichromate of potash.		Chromic ore.			
			Pounds.	Value.	L ^r ton.	Value.		
1882	2,500	\$50,906	2,419,875	\$261,006	.....	.....	\$261,048	\$15.8
1883..	3,020	60,000	1,991,140	308,681	.....	.....	209,019	2,995
1881..	2,040	35,000	2,593,115	210,677	2,377	\$73,580	284,383	.....
1885	2,700	40,000	1,418,509	92,556	12	2.9	92,834	.....
1883..	2,000	30,000	1,985,809	1,917.7	3,356	43,731	182,019	.....
1887	2,000	40,000	1,722,465	120,305	1.4	20,812	116,468	.....
1888..	1,500	20,000	1,755,489	143,312	4,440	46,735	190,328	.....
1889	2,700	40,000	2,025,108	175,693	5,470	50,665	270,932	.....
1890..	3,500	53,985	1,165,001	95,231	633	8,190	169,240	.....
1891..	.....	.....	1,234,085	95,951	4,092	56,982	184,498	.....

† Including value of imports of chromate and bichromate of soda.
*The statistics of production are for calendar years; imports and exports for fiscal years ending June 30.

CHEMICALS AND CHEMICAL FERTILIZERS.

REVIEW OF THE MARKET DURING 1891.

Heavy Chemicals.—The heavy chemical market during the year has been remarkably steady and void of unexpected features. The United Alkali Union, Limited, organized in England in November, 1890, has grown in strength to that degree which enables it to practically control outputs and prices on two continents. It has shown a conservative management, has made a point of limiting the supply to the demand, and has manipulated prices in a way calculated to dampen competition.

The demand has been fairly up to expectations, notwithstanding the general business depression of the year. The glassblowers' strike during midsummer caused a considerable falling off, but it was not of long duration, nor were its effects upon the trade of any great permanence. Prices, as will be seen by the annexed table, have been remarkably steady, showing but little change. Quotations on caustic soda, which were lowered in December by the "Union," and those of bleaching powder, which show fair advance of about 35c., are the two notable exceptions.

The placing of the business of bleach in the hands of one firm has established public confidence in the stability of the 1892 market, and about 60% of the business expected during the ensuing year has been placed. Contracts for delivery over 1892 in other brands have been quite generally placed, and the trade starts out on the new year with a good volume of business provided, and with prospects otherwise bright.

CAUSTIC SODA, 60%.

	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Highest.....	Cts. 37½	Cts. 35	Cts. 35	Cts. 34	Cts. 32½	Cts. 33	Cts. 32½	Cts. 33	Cts. 35	Cts. 33	Cts. 33	Cts. 315
Lowest.....	30	32½	30	30	32½	32	32½	32½	32½	32½	315	315

CARBONATED SODA ASH, 48%.

	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Highest.....	Cts. 162½	Cts. 165	Cts. 160	Cts. 160	Cts. 160	Cts. 160	Cts. 160	Cts. 162½	Cts. 165	Cts. 165	Cts. 160	Cts. 161
Lowest.....	155	157½	150	155	155	155	159	155	152½	160	157½	150

CAUSTIC SODA ASH.

	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Highest.....	Cts. 167½	Cts. 165	Cts. 162½	Cts. 160	Cts. 160	Cts. 170	Cts. 160	Cts. 162½	Cts. 162½	Cts. 162½	Cts. 162½	Cts. 162½
Lowest.....	150	160	156	155	155	155	150	155	155	157½	155	155

BLEACHING POWDER.

	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
High est.....	Cts. 175	Cts. 180	Cts. 175	Cts. 180	Cts. 180	Cts. 185	Cts. 185	Cts. 207½	Cts. 210	Cts. 210	Cts. 245	Cts. 230
Lowest.....	167	175	170	165	170	172½	175	190	197½	205	210	210

SAL SODA, ENGLISH.

	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Highest.....	Cts. 125	Cts. 110	Cts. 107	Cts. 110	Cts. 110	Cts. 115	Cts. 112½	Cts. 120	Cts. 120	Cts. 115	Cts. 115	Cts. 120
Lowest.....	110	107	102	100	100	107½	105	107½	110	105	110	112½

Acids.—The acid market has had its vicissitudes, which have been about equally divided between the favorable and unfavorable. Ruinous competition destroyed profits during the early months. In midsummer an attempt was made to form a combination for the purpose of bolstering up prices, but the committee having the matter in charge decided that no plan which it could devise would be practical. About that time an excellent demand, prompted by improved trade conditions, sprung up, and manufacturers turned their attention to securing their share of business. Since July trade has improved in so marked a degree that works have had all they could do to supply the demand. Contracts for 1892 are being made on a basis which will allow the manufacturers a fair margin of profit. Prices have advanced during the past six months, and are now about the following figures, per 100 lbs., in New York: Acetic, \$1.60 to \$2; alum, lump, \$1.55 to \$2; muriatic, 18°, \$1.12½ to \$1.25; 20°, \$1.25 to \$1.37; 22°, \$1.50 to \$1.75; nitric, 40°, \$4.50 and upward; 42°, \$6.50 to \$7.50; 66°, brimstone sulphuric, \$1½ to \$1.75; oxalic, \$7.25 to \$7.75. With the exception of certain sections of the East, where cut rates—a relic of "combination days" continue to rule, these quotations are firm.

Blue Vitriol.—The depression in the paris green trade has made transactions in blue vitriol very small during the year. Stocks were large, and through lack of demand the quotation fell to 3c., ruling on an average of 3½c. This exceedingly low figure has driven a number of the largest manufacturers into utilizing their copper in other ways; a number have put in electrolytic plants.

Brimstone.—See "Sulphur," page 48.

Fertilizers.—The chemical fertilizer market has just closed a fairly prosperous year. Of late years the business has become largely of a contract nature. The volume of trade has been good, prices have been well maintained, and 1892, with its general roseate business prospects, holds out bright promise to this section of the trade. The ammoniates have been in good demand, ruled steady, and closed a successful year at about the following figures: Bone sulphate, 3c.; dried blood, \$2.05 per unit; azotine, \$2.05; tankage, \$19 to \$21 per ton; bone meal, \$22 to \$23 per ton; acidulated fish scrap, \$12.50 per ton; dried scrap, \$23.50 per ton.

Muriate of potash, sulphate of potash and double manure salts have been under the syndicate control. They have ruled at the one price, and have all shown an increase in consumption. The phosphate market has been decidedly in buyers' favor, especially during the second half of the year. See "Phosphates: Their Consumption and Production," by Dr. Wyatt, on page 42.

The nitrate of soda market has advanced during the year because of the limited production which operators have controlled in accordance with the demand. It is asserted that this restriction will continue throughout the coming year. The demand in the United States during the year has been equivalent to that of 1890. In Europe it has increased during each of the past three years. The anticipated consumption in Europe and in the United States is fully up to that of last year, if not greater. The Chilean war had no permanent effect upon the industry, although there was an enforced stoppage during a limited period. As soon as ports were opened by the insurgents shipments were encouraged in order that the export duty of 2s. 6d. per cwt. could be obtained. Although the markets in the United States have not enlarged, they are all in good condition, as is evidenced by the continued increase in consumption. The prices which have ruled during the year are as follows:

	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Highest.....	Cts. 185	Cts. 210	Cts. 230	Cts. 230	Cts. 220	Cts. 215	Cts. 200	Cts. 185	Cts. 207	Cts. 215	Cts. 212½	Cts. 215
Lowest.....	170	207	212½	225	200	205	187½	172½	187½	207½	210	207

We are indebted to the courtesy of Mortimer & Wisner for the following statistics: Arrivals during the year, 640,000 bags; deliveries current December, 29,000 bags; deliveries during the year, 627,109 bags; stock on hand, 50,000 bags; visible supply to April 1st, 1892, 220,000 bags.

THE CHEMICAL MARKET IN 1891; VIEWS OF A PROMINENT DEALER.

The chemical trade is, we think, showing its most conspicuous change in its concentration among very few concerns, to which concentration we are unable to ascribe a cause, further than the general tendency of the times: 58% alkali and salt cake seem to have superseded to a large degree Le Blanc soda ash, which article has disappeared almost entirely from our markets. Caustic soda maintains its ground about as usual, except that the American make is increasing, but not any faster than the demand, while talk of new works in many parts of the country is daily heard in trade circles. The sale of bleaching powder has been placed with one firm, which has been appointed agent for the combined makers in Great Britain, which greatly simplifies the transactions in this article. To complete the line of what is known as heavy chemicals, bicarbonate of soda and sal soda should be mentioned, but nearly all of these two articles, consumed in this country, is now made here. The volume of business increases slightly every year and we look for the normal increase, with a steady market during 1892.

THE ACID MARKET IN 1891; VIEWS OF F. H. KALBFLEISCH, OF MARTIN KALBFLEISCH'S SONS' CO.

The acid market opened early in the year with rather a week feeling on the part of the manufacturers. Indications pointed to low prices owing to severe competition which still existed between remnants of the almost defunct chemical company organized in New Jersey, and the organization of a new plant in Connecticut. There were consolidation rumors in the air, but nothing has materialized thus far. About the middle of the year, notice was given by one of the old concerns that they intended discontinuing the business and immediately thereafter prices stiffened; this event, coupled with the increased demand, gave a firm tone to the market and the cutting of prices began to cease; toward the end of the year prices became very firm, and in most instances advanced.

Prospects for 1892 strongly favor the sellers. The consumption has increased, while the production has remained about the same, and, if any-

thing, has been curtailed slightly. The disposition manifested by most of the manufacturers seems to be to obtain figures that are slightly remunerative, and indications point to a strong probability of higher prices ruling during the coming year. The market at the present time seems to be entirely bare of the three principal acids, something that is unusual at this season.

THE FERTILIZER MARKET IN 1891; VIEWS OF MESSRS. HELLER, HIRSH & CO.

The condition of the fertilizer trade during the past year has been a very satisfactory one. The demand for fertilizers was larger than ever before, and at satisfactory prices, and the consumption of raw material was correspondingly large. Ammoniates of all kinds were in good supply, but did not exceed the demand. Prices ruled steady, though on a moderate plane.

The market for phosphate rock was also quite steady until near the close of the year. Prices, especially for the South Carolina product, ruled high at uniform rates, fixed by the Charleston Exchange, and this in spite of the competition of the Florida producers. The past two weeks have seen a decided change in these conditions, as the Charleston phosphates have suffered a material decline in prices. This will seriously affect the prices of the Florida product, and it will be some time before we can expect former conditions renewed. One of the main reasons for the decline in Florida phosphate has been the attitude of the European market, induced by injudicious offerings of phosphates by brokers abroad and here. In the face of advancing freight rates prices have been sharply and constantly declining, owing rather to the bear tactics of the foreign manufacturer (due to forced offerings from here) than to any actual excess in supply, which has certainly not been as enormous as represented.

The importation of kainit during 1891 has exceeded 100,000 tons, as against 65,000 tons for 1890. The amount of sylvinit imported in each of these years was about 7,500 tons. In manure salts the figures in round numbers are as follows: High grade manure salt, 90% to 98% sulphate of potash: 1891, 4,150 tons; 1890, 3,500 tons. Double manure salt, 48% to 53% sulphate of potash: 1891, 8,850 tons; 1890, 9,500 tons. Referring to the last named figures, the fact is that the consumption of double manure salt for the year 1891, as for all the other potash salts, exceeded that for the year 1890, as a large proportion of the importation made during the latter year did not go into consumption until 1891. The prices for all these salts have ruled steady, and as the result of the efforts of the syndicates' agents the supply has just kept pace with the demand. The prices of kainit and sylvinit for the coming year remain unchanged, but in high grade sulphate of potash and double manure salt, as also for muriate of potash, a small advance in price is announced due to a similar advance for the goods at the mines in Germany, applying equally to the European and American markets.

The outlook for the coming year in the chemical fertilizer industry is a good one, as our eastern, northern and western farmers have enjoyed an exceptionally prosperous year by the coincidence of unprecedented large crops at home and the serious failure of crops abroad. In the South the prospects are not so bright, owing to the large cotton crop and the low prices at which cotton has been ruling. But this condition bears its own remedy. At present low prices, cotton within a short time will be used in very many industries that have heretofore employed cheaper and poorer fibers. The increased demand from these new sources will soon dispose of the large stocks, when an improvement in prices may be looked for. The planters in the South can contribute toward this by a judicious reduction in cotton planting and by a diversification of their crops with food and feed products. The consumption of complete fertilizers in the United States has increased enormously year by year, and their manufacture now holds an important place among our industries.

MURIATE OF POTASH; VIEWS OF H. H. CALMON.

The growth of the trade in this article has been steadily assuming greater proportions year by year, and large quantities are now being used principally for fertilizing purposes in various sections of the country, particularly in the South, and on the Pacific coast, where a few years ago only small lots were taken for experimental purposes. The bulk of the imports of all muriate of potash finds its way into the mixtures of the fertilizer manufacturers, of which it forms a valuable and indispensable part. Saltpetre manufacturers are also large consumers, producing from this article and nitrate of soda the so-called converted saltpetre, used extensively by powder manufacturers. To a smaller extent muriate of potash is used for making bichromate of potash, and a very limited quantity is absorbed by cream of tartar manufacturers.

Muriate of potash has always been admitted to this country free of duty; nevertheless the importers have not been spared the effects of the new tariff, on account of the duty having been taken off some other articles, such as sulphate of potash and Bengal saltpetre, the former taking the place of muriate in the manufacture of alum, and the latter being more extensively used by saltpetre manufacturers. However, the loss in this direction has been fully made up by the increased demands from the fertilizer trade. The highly satisfactory results derived from the application of muriate of potash, coupled with the facilities afforded to buyers in being able to obtain their requirements by direct shipments from Germany to every principal port of the country nearest to point of consumption at the shortest notice, its low cost, and its large percentage of pure potash, do not fail to convince buyers of the advantages offered by the use of this cheap and very desirable source of potash.

The year opened with but light stocks at all ports, and although importers prepared themselves at the very beginning of the season to meet the heavy demand anticipated, they were somewhat handicapped in their efforts to obtain the large supplies required in time, owing to the extremely severe winter then prevailing in Germany, which caused a great deal of annoyance and delay to shippers, and was only overcome by degrees. After the re-opening of the navigation on the River Elbe, shipments came forward with usual regularity and were very heavy throughout the year. The depression in the fertilizer trade in the South, caused by the low price of cotton, has naturally exerted its influence

upon the sales in muriate, but, in spite of all this, the volume of business transacted has been larger than ever before, as shown by the receipts at all the ports for the last three years, amounting to nearly 34,000 tons in 1891 against 29,780 tons in 1890, and 28,745 tons in 1889. On account of higher cost of production at the mines, the German syndicate found it necessary to advance the price for muriate for shipment during 1892 six cents per 100 lbs., basis 80%, as compared with last year's figures. The present prices per 100 lbs., basis 80%, are as follows:

To New York and Boston, \$1.78½; to Philadelphia and Baltimore, \$1.81; to Southern ports, \$1.82½. These figures are for goods contracted for on or before January 7th, 1892. After that date prices will be advanced 3c. per 100 lbs. Owing to the advance in price, all shipments offered at last year's lower quotations have been readily taken up, and the year closed with but light stocks in first hands.

ON THE PROGRESS OF SOME OF THE LARGE CHEMICAL INDUSTRIES IN EUROPE DURING 1891.

By Geo. Lunge, Ph. D., Professor at the Polytechnic School, Zurich, Switzerland.

I have been asked by the editor of the ENGINEERING AND MINING JOURNAL to write a short review of the industries with which I am connected for this Annual Statistical Number. Unfortunately I am not in a position to imitate the truly marvelous feat annually repeated by the ENGINEERING AND MINING JOURNAL, by which a detailed and trustworthy statistical report on the movement of the American metallurgical and chemical industries is presented immediately after the close of the year to which it refers. We do not move quite as fast as that over here, and I must, therefore, entirely abstain from statistics, which in Europe are not yet obtainable for the current year, and confine myself to some general remarks on European chemical industries in 1891.

The manufacture of heavy chemicals has been moving very much in the old grooves; but it has been going on vigorously, and, in consequence of checking overproduction by means of amalgamations and conventions, both in England and Germany (I believe also in France), a fair profit has been made. There are, however, signs that the existing organizations will not be left for a long time in undisputed possession of the field, and that, moreover, the old lines of manufacturing processes may be broken through in some important points.

The manufacture of sulphuric acid has been carried on as usual. The "plate-columns," invented by the present writer for the purpose of materially reducing the chamber space and improving other parts of the process, have been successfully introduced at several works; this process will probably prove the subject of a special article in a future number. Some stir has been made about the new Delplace system of circular chambers, but it is as yet impossible to make a final estimate of their economical success, which is doubted by many of those who have given attention to this matter.

The immense rise in the price of platinum had for a time checked the extension of platinum concentrating apparatus, and called forth several new proposals in that line, none of which has as yet met with decided success; since the price of platinum has considerably receded, stimulus for special exertions in that field has correspondingly decreased. Gold-lined platinum stills, on the system of W. H. Heraeus, in Hanau, have been proved to be very economical in the matter of wear and tear.

Both the Leblanc and the ammonia alkali manufacture have been carried on without any visible change compared with the year 1890. The great expectations raised by the Chance process for recovering the sulphur from alkali-waste have been partially checked, both by the troubles caused by frequent escapes of sulphuretted hydrogen and by the insufficient recovery of the sulphur. It seems certain that at the present prices of pyrites the Chance process cannot compete with pyrites for the manufacture of sulphuric acid; nor is the manufacture of brimstone from the gases of that process in the Claus kilns anything like an ideally perfect operation. Some of the Chance plants put up in England have not even been started for work, but the majority are working and doing fairly well.

Several other proposals for superseding the Leblanc process, partially or entirely, such as the Haddock and Leith process and the Ellershausen process, are still in their initial stages.

The most interesting question in this domain remains as before: Can alkali (together with chlorine) be made by electricity in an economical way or not? The answer to the best of my knowledge is as follows: Potash (caustic) and chlorine are actually made from Stassfurt chloride—what profits I do not know. Chlorate of potash is certainly made in this manner. Soda, however, is not yet manufactured anywhere by electricity, and at the present moment this seems still impracticable even with cheap water-power. It is a different question whether it pays to electrolyze sodium chloride, in order to utilize both soda and chlorine on the spot, as they are formed, for manufacturing and bleaching paper-pulp and analogous purposes. This, as is well known, is the object of the Kellner-Partington process. It would seem, as if such a process must pay, if only the engineering difficulties can be entirely overcome, but in spite of very confident assertions to that purpose the process has not yet made any decisive progress outside its first limits.

Great progress has been made in the manufacture of chlorine by the Deacon process, in which now the "roaster acid" can be utilized by means of Hasenclever's improvements. This process, which had been stationary for a good many years is now decidedly extending, especially in France. Several of the new processes employing nitric acid for the production of chlorine and the De Wilde Reyehler process (a magnesium-manganese process) are also being vigorously pushed forward, and may ultimately compete with the Deacon process even in its improved form. The prediction that the Stassfurt magnesium chloride would become the world's purveyor of chlorine seems very far from realization, but it is a fact that at least some hydrochloric acid from this source is now in the market. Liquid chlorine, confined in steel boxes, is now a regular article of trade in Germany.

Compressed oxygen is more and more used on a large scale; it is still exclusively made by the improved Biin process, the Kassner process, in spite of vigorous advertising, not having progressed beyond the experimental stage.

CENSUS REPORT OF THE PRODUCTION OF COAL IN THE UNITED STATES IN 1889. [In tons of 2,000 lbs.]

STATES.	Production.				Disposition of total product.			Expenses.			
	Mines.	Total production.	Value at mines.	Average value per ton.	Shipped.	Used for steam, by employes, and sold to local trade.	Made into coke.	Number of employes.	Wages paid.	Total expenditures.	Capital invested.
Bituminous.											
Alabama.....	79	3,572,983	\$2,961,491	\$1.11	2,327,209	139,460	1,106,314	6,975	\$3,267,857	\$3,726,939	\$12,535,194
Arkansas.....	27	279,584	395,836	1.42	268,518	11,066	686	686	252,679	308,711	1,289,751
California and Oregon.....	10	184,179	434,382	2.36	173,611	10,568	419	419	248,449	364,942	526,750
Colorado.....	103	2,544,144	3,843,992	1.51	2,059,848	176,235	308,061	4,872	2,724,800	3,695,298	12,611,849
Georgia and N. C.....	3	226,156	339,382	1.50	46,321	15,190	164,645	740	265,464	426,065	724,500
Illinois.....	1,072	12,104,272	11,755,203	0.97	9,884,883	2,206,489	12,900	24,323	8,694,347	10,366,669	17,630,351
Indiana.....	350	2,845,057	2,887,852	1.02	2,527,112	305,145	12,800	6,532	2,201,044	2,581,669	3,435,703
Indian Territory.....	15	752,832	1,323,807	1.76	689,122	41,092	12,618	1,873	927,267	1,172,821	1,492,009
Iowa.....	392	4,095,358	5,426,509	1.33	3,530,373	564,948	37	9,384	3,956,788	4,732,950	6,279,179
Kansas and Nebraska.....	424	2,222,443	3,301,783	1.49	1,891,090	330,853	270,287	6,069	2,322,588	2,730,782	3,488,539
Kentucky.....	1,841	2,398,755	2,374,339	0.99	2,111,010	270,287	18,438	5,260	1,756,365	2,156,548	6,581,380
Maryland.....	81	2,939,715	2,517,474	0.86	2,885,333	54,379	3,741	265	1,730,687	2,061,037	18,025,367
Michigan.....	12	67,431	115,011	1.71	53,104	14,327	1,028	76	93,594	113,714	49,650
Missouri.....	478	2,557,823	3,479,057	1.36	2,246,845	319,978	6,730	3,741	2,538,273	2,846,137	3,992,293
Montana.....	30	363,301	880,773	2.42	314,372	18,353	30,576	857	587,538	649,674	1,153,076
New Mexico.....	28	486,463	870,468	1.79	466,127	14,336	6,000	1,028	604,543	776,896	995,717
North Dakota.....	342	28,907	41,431	1.43	18,610	10,297	76	76	18,460	21,740	66,580
Ohio.....	2,068	9,976,787	9,355,400	0.94	8,566,223	1,341,095	69,469	19,591	6,892,604	8,232,183	14,018,236
Pennsylvania.....	3,474	36,174,089	27,953,315	0.77	24,059,913	1,923,588	10,190,588	53,712	20,738,647	25,977,106	53,322,330
Tennessee.....	82	1,925,089	2,338,309	1.21	1,334,424	52,135	539,130	4,198	1,600,310	2,113,292	4,362,711
Texas.....	10	1,23,216	340,029	2.66	120,602	7,614	549	549	256,834	324,157	307,335
Utah.....	11	236,651	377,456	1.59	219,960	17,474	2,217	565	268,570	342,796	844,560
Virginia.....	58	865,786	804,475	0.93	732,881	12,635	2,685	1,555	621,266	682,406	1,055,516
Washington.....	12	1,030,578	2,393,238	2.32	956,046	35,532	112,210	2,685	1,747,080	2,254,486	3,186,441
West Virginia.....	1,111	6,231,880	5,086,584	0.82	4,764,900	530,655	936,325	9,952	3,888,712	4,841,796	10,508,050
Wyoming.....	25	1,388,947	1,748,617	1.26	1,354,443	34,504	2,692	2,692	1,553,947	1,829,252	2,239,252
Total.....	12,128	95,629,026	\$94,346,809	\$0.99	73,609,883	8,457,295	13,561,848	175,249	\$69,765,711	\$85,324,193	\$180,722,319
Anthracite.											
Pennsylvania.....	411	45,544,970	\$65,721,578	\$1.44	40,114,901	5,430,069	.....	124,203	\$39,278,355	\$61,109,958	\$161,784,473
Colo., N. M. and R. I.....	3	55,517	157,936	*	51,917	3,600	.....	107	86,862	102,129	251,137
Total.....	414	45,600,487	\$65,879,514	\$1.44	40,166,818	5,433,669	.....	124,310	\$39,365,217	\$61,212,087	\$162,035,610
Grand total.....	12,552	141,229,513	\$160,226,323	\$1.13	113,776,701	13,890,964	13,561,848	299,559	\$109,130,928	\$146,536,280	\$342,757,929

* \$3.00 at Rhode Island mines; \$2.84 in Colorado and New Mexico.

AREA AND PRODUCT AT ELEVENTH CENSUS OF THE ANTHRACITE COAL FIELDS COMPARED WITH THOSE REPORTED BY THE TENTH CENSUS.

States and Territories.	1889.		1879.	
	Coal area in Sq. Miles.	Production.	Coal Area in Sq. Miles.	Production.
New England basin, (Rhode Island and Massachusetts).....	500	2,000	500	6,176
Pennsylvania.....	470	45,544,970	470	28,648,819
Virginia.....	.....	.....	.....	2,817
Colorado and New Mexico.....	15	53,517	.....	.....
Total.....	985	45,600,487	970	28,649,812

COAL.

THE ANTHRACITE COAL MARKET IN 1891.

The anthracite coal trade during the year 1891 has been remarkable in many respects, though on the whole it has emphasized the fact that the laws of supply and demand cannot be disregarded without bringing disastrous consequences. The most prominent fact in the trade has been the production of about 40,500,000 tons of 2,240 pounds, the largest output in its history, and an increase of about 5,000,000 tons over that of the preceding year, and exceeding by about 1,000,000 tons the increase in three years prior to 1891 (for there was an actual decrease of 2,738,000 tons in 1889 as compared with 1888). The stocks of anthracite at tide water on December 1st, 1891, were 637,846 tons, which was practically the same amount as on February 1st; and the stocks at interior storage points, including lake ports, are not very large. Consequently the greater part of this tonnage has been consumed.

The history of the sales agents, actions from month to month has been, as usual, a record of broken promises and of a scramble for tonnage without much regard for official prices. At, or near, the close of each month the output for the incoming month was "fixed" officially. The aggregate of these stipulated monthly outputs was 34,700,000, an amount which the sales agents thought could be marketed and prices maintained. While the actual shipments amounted to 40,414,905 tons.

The January, February and March outputs so far exceeded the allotments of 2,500,000 tons each month that both the dealer and the customer lost faith, and the demand became of a hand to mouth nature. The market thus seriously affected was brought back to a healthy condition only by a very determined effort on the part of the companies.

The opening of July found the trade in good shape to meet the mid-summer dullness. Prices had been advanced to \$3.65 for broken, \$3.85 for egg, \$4.05 stove and \$3.75 for chestnut. Owing to the slow demand and the higher circular prices, the companies began to extend the time of delivery on orders, until the prices of one month practically extended over several in which higher prices had been ordered. The consumers grew suspicious and bought only to supply immediate requirements. The independent operators naturally captured most of the little business offering, but the companies were not slow to meet these cuts in prices. Over-production continued heavy and the trade became so demoralized that the presidents of the producing companies held a meeting, the first for the purpose in years, and it was reported that they guaranteed that

DISTRIBUTION ACCORDING TO STATES OF THE OUTPUT OF BITUMINOUS COAL.

	Coal area in square miles, 1887 and 1888.	Production, 1887.	Production, 1888.	Coal area in square miles, 1889.	Production, 1889.
Triassic:					
Virginia.....	180	30,000	33,000	185	49,411
N. Carolina.....	.....	.....	.....	2,700	222
				2,885	49,633
Appalachian:					
Pennsylvania.....	9,000	30,806,602	33,796,727	9,000	36,174,089
Ohio.....	10,000	10,301,708	10,910,946	10,000	9,976,787
Maryland.....	550	3,278,023	3,479,470	550	2,939,715
Virginia.....	185	795,243	1,040,000	2,000	816,375
W. Virginia.....	16,000	4,836,820	5,498,800	16,000	6,231,880
Kentucky.....	9,000	950,903	1,193,000	10,000	1,108,770
Tennessee.....	5,100	1,900,000	1,967,237	5,100	1,925,689
Georgia.....	200	313,715	180,000	200	225,934
Alabama.....	8,600	1,950,000	2,900,600	8,600	3,572,983
	58,695	55,193,034	60,966,240	61,510	62,972,220
Northern:					
Michigan.....	6,700	71,461	81,407	7,000	67,431
Central:					
Indiana.....	6,450	3,217,711	3,140,979	7,000	2,845,057
Kentucky.....	4,000	982,282	1,377,000	4,000	1,290,985
Illinois.....	36,800	10,278,890	14,658,188	37,000	12,104,272
	47,250	14,478,883	19,173,167	48,000	16,240,314
Western:					
Iowa.....	18,000	4,473,828	4,952,440	18,000	4,095,358
Missouri.....	26,857	3,209,916	3,909,967	26,900	2,557,823
Nebraska.....	3,000	1,500	1,500	3,200	2,222,443
Kansas.....	17,000	1,596,879	1,850,000	17,000	1,730,687
Arkansas.....	9,043	150,000	276,871	9,100	279,584
Indian Ter.....	.....	685,911	761,985	26,000	752,832
Texas.....	4,500	75,000	90,000	4,500	128,216
	10,193,034	11,842,764	98,700	10,036,256	
Rocky Mountains, etc.:					
Dakota.....	21,470	24,000	.....	.....	28,907
Montana.....	10,202	41,467	.....	.....	363,301
Idaho.....	500	400	.....	.....	.....
Wyoming.....	1,170,313	1,481,540	.....	.....	1,388,947
Utah.....	180,021	258,961	.....	.....	258,651
Colorado.....	1,755,735	2,149,686	.....	.....	2,544,144
New Mexico.....	508,034	626,665	.....	.....	486,463
	3,646,280	4,583,719	.....	.....	5,048,413
Pacific Coast:					
Washington.....	772,612	1,215,750	.....	.....	1,030,578
Oregon.....	31,696	75,000	.....	.....	64,359
California.....	50,000	95,000	.....	.....	119,820
	854,308	1,385,750	.....	.....	1,214,757
Total product.....	84,395,489	98,066,047			95,629,026

restriction in output would be rigidly maintained. This action had a beneficial effect upon the trade. Public confidence was somewhat restored, with the prospect of an excellent fall business. A more healthy

condition ruled for a short time, when the usual overproduction re-commenced

During the autumn months the tide-water market was greatly overstocked. The business done was mostly at concessions by the independent operators, for the companies were firm in their prices, to a very unusual degree. The brisk Western demand, however, took at full prices nearly all of the available stock to the close of navigation, or about December 1st, though production was exceedingly heavy, reaching in October 4,496,534 1/2 tons, the largest month's output in the history of the trade. After the close of lake navigation a heavy tonnage was thrown upon the Eastern market and prices, already weak, were further demoralized. At the close of the year they ruled normally at the September circular rates, but in reality were all in buyers' favor.

Among the notable events of the year was the decision, early in March, by the Interstate Commerce Commission in the case of Coxe Bros. & Co. vs. the Lehigh Valley Railroad Company. In this case the plaintiffs sought to secure concessions in the freight rates on coal. The Commission decided that the railroad company could properly make a discrimination in freight rates between bituminous and anthracite coals, as between the rates on the larger and more valuable sizes and the smaller and cheaper sizes of anthracite, but it decided that the ruling freight rates were too high and ordered a reduction from \$1.70, \$1.40 and \$1.20 per ton according to sizes of coal to \$1.50, \$1.25 and \$1.05 respectively. The findings were ordered to take place on April 20th. On that date the railroad company refused to make the reduction, and Coxe Bros. & Co. served notice that it would pay the excess only under protest. Later in the year the Interstate Commerce Commission brought suit in the United States Court at Philadelphia, Pa., against the Lehigh Valley Railroad Company, seeking to compel a compliance with its mandate. A hearing was postponed from time to time until the middle of December when the preliminary motions were argued. The defendant claimed that the court could not enforce the Commission's decision without first rehearsing the case. The matter is now under advisement, and the defendant cites a precedent in the form of a decision of the Supreme Court of Mississippi on this point. An enforcement of this ruling would eventually reduce the transportation charges 15c. and 20c. on all coal moving to tide water, and while turning that sum of money from the railroad companies' exchequers, it would place it in the pockets of the coal companies, or perhaps in those of consumers where it would undoubtedly "do the most good". The effect of the Lehigh Valley Railroad in resisting fair rates was shown in May when Coxe Bros. & Co. contracted to transfer to the Philadelphia & Reading Railroad Company the yearly haulage of 1,000,000 tons of coal heretofore placed with the Jersey Central, Lehigh Valley and Pennsylvania railroad companies, reserving the right to place the balance of its product on from 500,000 and 1,000,000 tons where found desirable. For the purpose of making the necessary railroad connections Coxe Bros. & Co. extended its own road, the Delaware, Susquehanna & Schuylkill Railroad, to connect with the Philadelphia & Reading Railroad Company which built a 10 mile line from Lofty.

This change naturally gave rise to the very important question of the quota to be allowed each of the carrying companies in next year's business. President McLeod, of the Philadelphia & Reading, in his last annual report stated that he intended to add materially to his coal production. This, coupled with the acquisition of Coxe Bros. & Co.'s tonnage, has given rise to a variety of reports.

The allotment of the tonnage among the roads has in the past been a fruitful source of disagreement, and the coming year well may provide a new "war" on this foundation. It is very certain that if the Reading Company is ever to become a valuable property to its stockholders it must be doing a greatly increased business and securing a much larger proportion of the anthracite tonnage than it has had for many years past. The company logically is entitled to this; and if its financial condition is such as to enable it to "fight for it," it will probably obtain it. The question centers altogether on this; should the rival companies conclude that the Reading cannot stand a "war," they will of course refuse to give up any part of their present percentage of the trade. The present management of the Reading is credited with great sagacity, and is not likely to make a demand it is not prepared to stand for, and, if it can convince the other roads of its ability to do this, it will probably attain its end without a serious conflict. At present, the sky is overcast, and the air seems charged with the elements of a storm which, if it should break, might send the coal stocks down on a grade where it would be difficult to stop some of them short of the ragged edge of bankruptcy. There is nothing yet apparent, however, that precludes the breaking of the clouds and the continuance of amicable relations between the companies during the coming year. The prospects for an enormous business in 1892 are excellent, and perhaps the market will call for so much coal that all can work to nearly full capacity regardless of quota.

At the sales agents' meeting held on December 29th the unanimous opinion was that a policy of radical restriction was absolutely necessary to restore equilibrium, and to this end it was recommended that the January output be limited to 2,000,000 tons, exclusive of the Pennsylvania and New York, Ontario & Western interests.

An adjournment of a week may be taken to allow the recommendation to be acted upon by the companies' directors. Whether this will be more effective than the hundred similar "recommendations" for restricting output which have never materialized is a question that probably will be decided in "the trade" according to the amount of experience and the "memory" of each individual. A good memory is fatal to confidence or faith in combination compacts.

TABLE SHOWING OUTPUTS FIXED AT THE BEGINNING OF EACH MONTH DURING THE YEAR BY THE SALES AGENTS.

January	2,500,000	August	3,000,000
February	2,500,000	September	2,500,000
March	2,500,000	October	3,750,000
April	2,000,000	November	4,000,000
May	2,000,000	December	3,250,000
June	3,000,000		
July	3,000,000	Total for the year	34,700,000

ANTHRACITE COAL SHIPMENTS AND TOTAL PRODUCTION OF PENNSYLVANIA.

YEARS.	WYOMING REGION.		LEHIGH REGION.		SCHUYLKILL REGION.		Total shipm'ts tons.
	Shipm'ts	Pro-duction.	Shipm'ts	Pro-duction.	Shipm'ts	Pro-duction.	
Before 1820	10,000	.....	3,000	.....	5,000	.....
1820	800	.....	365	.....	500	.....
1821	1,000	.....	1,073	.....	800	.....
1822	1,200	.....	2,240	.....	1,480	.....
1823	1,300	.....	5,823	.....	1,128	.....
1824	1,700	.....	9,541	.....	1,567	.....
1825	2,000	.....	28,393	.....	6,500	.....
1826	2,700	.....	31,280	.....	16,767	.....
1827	4,000	.....	32,074	.....	31,360	.....
1828	6,200	.....	30,232	.....	47,284	.....
1829	7,000	.....	25,110	.....	79,973	.....
1830	43,000	.....	58,300	.....	89,984	.....
1831	54,000	.....	40,966	.....	81,854	.....
1832	84,000	.....	78,300	.....	209,271	.....
1833	111,777	.....	123,001	.....	252,971	.....
1834	43,700	.....	106,244	.....	226,692	.....
1835	90,000	.....	131,250	.....	339,508	.....
1836	103,861	.....	148,211	.....	432,045	.....
1837	115,347	.....	223,902	.....	530,152	.....
1838	78,207	.....	213,615	.....	445,875	.....
1839	122,300	.....	221,225	.....	476,077	.....
1840	148,470	.....	225,313	.....	490,596	.....
1841	192,270	.....	229,955	.....	624,466	.....
1842	252,599	.....	272,540	.....	583,273	.....
1843	245,605	.....	267,793	.....	710,200	.....
1844	365,911	.....	435,434	.....	448,633	.....
1845	451,236	.....	546,329	.....	509,761	.....
1846	518,389	.....	614,291	.....	517,116	.....
1847	583,067	.....	689,185	.....	635,507	.....
1848	685,196	.....	808,531	.....	67,321	.....
1849	732,910	.....	892,635	.....	920,000	.....
1850	827,823	.....	972,692	.....	811,286	.....
1851	1,156,167	.....	1,355,028	.....	1,130,071	.....
1852	1,284,500	.....	1,502,865	.....	1,254,399	.....
1853	1,475,732	.....	1,723,655	.....	1,231,433	.....
1854	1,693,478	.....	1,868,632	.....	1,466,372	.....
1855	1,771,511	.....	2,060,267	.....	1,284,113	.....
1856	1,972,581	.....	2,288,144	.....	1,351,970	.....
1857	1,952,603	.....	2,261,114	.....	1,318,541	.....
1858	2,186,094	.....	2,527,125	.....	1,380,030	.....
1859	2,731,236	.....	3,15,846	.....	1,628,311	.....
1860	2,941,417	.....	3,388,973	.....	1,821,674	.....
1861	3,055,140	.....	3,513,411	.....	1,798,377	.....
1862	3,145,770	.....	3,698,198	.....	1,851,034	.....
1863	3,759,610	.....	4,304,754	.....	1,894,713	.....
1864	3,960,836	.....	4,526,635	.....	2,054,669	.....
1865	3,254,519	.....	3,720,717	.....	2,040,913	.....
1866	4,736,616	.....	5,413,958	.....	2,082,858	.....
1867	5,325,000	.....	6,089,272	.....	2,179,364	.....
1868	5,968,146	.....	6,846,699	.....	2,502,094	.....
1869	6,141,369	.....	7,279,543	.....	2,502,582	.....
1870	7,974,660	.....	8,814,024	.....	2,582,820	.....
1871	6,911,242	.....	7,667,129	.....	2,313,689	.....
1872	9,101,549	.....	10,698,523	.....	3,239,374	.....
1873	10,302,755	.....	11,711,033	.....	3,239,374	.....
1874	9,504,408	.....	10,204,764	.....	2,235,707	.....
1875	10,596,155	.....	11,231,924	.....	2,508,784	.....
1876	8,424,158	.....	8,929,607	.....	3,801,447	.....
1877	8,300,377	.....	8,798,399	.....	3,773,836	.....
1878	8,085,587	.....	8,570,722	.....	3,489,364	.....
1879	12,586,293	.....	13,341,475	.....	4,348,280	.....
1880	11,419,279	.....	12,104,435	.....	4,947,478	.....
1881	13,951,383	.....	14,784,465	.....	5,562,826	.....
1882	13,971,371	.....	14,809,653	.....	6,008,026	.....
1883	15,604,492	.....	16,540,761	.....	6,463,270	.....
1884	15,677,753	.....	16,618,418	.....	6,870,529	.....
1885	16,236,470	.....	17,210,558	.....	7,139,809	.....
1886	17,031,826	.....	18,053,736	.....	7,582,436	.....
1887	19,684,929	.....	20,866,625	.....	8,195,042	.....
1888	21,852,306	.....	23,163,508	.....	8,686,744	.....
1889	18,654,454	.....	19,777,721	.....	8,859,567	.....
1890	18,657,994	.....	19,777,156	.....	9,478,478	.....
1891	21,353,046	.....	22,634,329	.....	10,074,726	.....

The consumption at the mines is estimated at 8% of the shipments and added to these gives the total production. * In tons of 2,240 lbs.

PRICES FOR FREE BURNING COALS, F. O. B. GROSS, AS ESTABLISHED AT DIFFERENT PERIODS OF THE YEAR (1891) BY THE SALES AGENTS.

Prices for free burning coals, f. o. b. gross, as established at different periods of the year (1891) by the sales agents, were as follows:

1891.	Jan.	April	June.	July.	Sept.	Oct.	Nov.
Broken	\$3.75	\$3.56	\$3.65	\$3.65	\$3.65	\$3.75	\$3.75
Egg	4.10	3.60	3.75	3.85	4.00	4.15	4.15
Stove	4.20	3.75	3.90	4.05	4.25	4.40	4.40
Chestnut	3.75	3.50	3.65	3.75	4.00	4.15	4.15

The official f. o. b. gross prices established on free burning coals during 1890 were as follows:

1890.	May 17.	June.	July.	Sept.	Oct.	Nov.	Dec.
Broken	\$3.40	\$3.35	\$3.65	\$3.50	\$3.75	\$3.75	\$3.75
Egg	3.40	3.50	3.75	3.90	4.05	4.10	4.10
Stove	3.50	3.75	4.00	4.15	4.30	4.40	4.40
Chestnut	3.25	3.50	3.65	3.75	3.95	3.95	3.95

PROPORTIONAL SHIPMENTS OF ANTHRACITE BY THE SEVERAL COAL ROADS.

Roads.	1891.		1891*	
	Shipments. Tons.	Per cent.	Shipments. Tons.	Per cent.
Philadelphia & Reading	7,527,600	20.99	8,391,824	20.8
Lehigh Valley	6,768,495	18.87	7,204,308	17.8
Central Railroad of New Jersey	5,615,640	15.66	5,951,114	14.7
Delaware, Lackawanna & Western	5,792,769	16.15	6,106,075	15.1
Delaware & Hudson Canal	3,674,800	10.25	3,893,119	9.6
Pennsylvania Railroad Company	4,017,690	11.20	5,165,990	12.8
Pennsylvania Coal Co.	1,428,485	3.98	1,739,090	4.4
New York, Lake Erie & Western	1,029,785	2.87	1,242,007	3.1
New York, Ontario & Western	.....	.....	699,896	1.7
	35,855,174	100.00	40,414,898	100.00

* Based on the monthly shipments made by respective roads for ten months, plus aggregate returns for November weekly returns for first half of December and estimated for remainder of that month.

PROPORTIONAL SHIPMENTS OF ANTHRACITE BY THE SEVERAL COAL ROADS
Tons of 2,210 pounds.

ROADS.	1890.		1879.		1878.		1877.		1873	1868
	Ship-ments.	Per cent.	Ship-ments.	Per cent.	Ship-ments.	Per cent.	Ship-ments.	Per cent.	to 1876.	to 1872.
Reading RR.	5,933,923	25.31	7,447,617	28.47	5,112,219	29.3	6,342,105	32.83	27.84	30.55
Cent. N. J.	3,370,141	14.80	3,523,553	14.33	2,254,979	12.8	2,875,501	13.62	13.41	10.97
Lehigh Valley	4,291,533	18.75	4,403,957	16.86	3,443,319	19.33	4,511,331	21.05	21.04	19.26
D. L. & W.	3,550,348	15.35	3,837,407	14.79	2,180,072	12.3	2,194,533	10.13	12.26	11.72
D. & H.	2,674,704	11.41	3,014,117	11.53	2,046,235	11.6	1,918,617	9.21	12.06	13.72
Pa. RR.	1,861,032	7.96	1,682,106	6.88	1,302,673	7.7	1,530,594	7.35	8.04	7.42
Pa. Coal Co.	1,138,466	4.90	1,227,150	4.46	957,032	5.4	1,118,011	5.31	6.35	6.96
Erie.	411,004	1.75	477,782	1.83	278,132	1.5	...	...	...	...
Total	23,437,242		26,142,689		17,605,261		21,847,681			

ROADS.	1835.		1841.		1853.		1862.		1881.	
	Ship-ments.	Per cent.	Ship-ments.	Per cent.	Ship-ments.	Per cent.	Ship-ments.	Per cent.	Ship-ments.	Per cent.
Read. RR.	11,680,780	30.94	11,163,020	30.30	12,232,401	38.49	7,000,113	24.04	6,940,328	24.95
Cent. N. J.	6,107,445	19.32	5,935,254	19.3	6,271,773	19.7	4,211,032	14.46	4,085,423	14.8
Lehigh Val.	4,937,834	15.74	5,204,362	16.93	5,079,121	15.97	5,638,740	20.38	5,721,869	21.7
D. L. & W.	3,831,874	10.74	3,302,680	10.63	3,512,972	11.07	4,638,717	15.93	4,388,162	15.90
D. & H.	3,393,685	10.74	3,169,287	10.3	2,774,419	8.72	3,233,474	11.07	3,211,461	11.27
Pa. RR.	1,500,686	4.71	1,397,946	4.53	1,541,114	4.86	1,498,821	5.05	1,475,380	5.18
Pa. Coal Co.	651,226	2.07	523,546	1.71	383,194	1.20	330,511	1.13	465,230	1.63
Total ship-ments.	31,623,530		30,756,905		31,798,027		29,120,096		28,500,016	
Consumption at mines = 6 per cent of ship-ments	1,877,411		1,845,420		1,907,587		1,747,206		1,710,001	
Total production	33,500,941		32,602,415		33,705,615		30,867,302		30,210,017	

	1889.		1888.		1887.		1886.	
	Ship-ments.	Per cent.	Ship-ments.	Per cent.	Ship-ments.	Per cent.	Ship-ments.	Per cent.
Phil. & Reading	7,384,092	20.51	7,175,095	18.80	7,555,252	21.81	6,665,732	21.83
Cent. N. J.	6,073,409	18.10	5,742,279	15.05	4,832,859	14.90	4,894,752	15.93
Lehigh Valley	7,497,830	21.11	6,592,716	17.28	5,784,451	16.69	6,184,456	19.24
D. L. & W.	5,295,240	14.91	6,996,192	18.34	6,220,793	17.94	5,172,023	16.99
D. & H.	3,777,380	10.63	4,486,188	11.81	4,048,239	11.68	3,480,887	10.83
Penn. R. R.	3,233,027	9.82	4,564,441	11.98	3,816,143	11.01	3,478,885	10.82
Pa. Coal	1,333,925	3.97	1,624,434	4.26	1,934,456	5.62	1,393,170	4.35
Erie	951,824	2.82	794,374	2.08	759,835	2.19	731,650	2.20
Total shipments	35,507,327		38,145,718		34,641,019		32,136,362	
Consumption at mines	2,130,439		2,288,743		2,078,461		1,928,181	
Total production	37,637,766		40,434,461		36,719,479		34,064,543	

OUTPUTS AND STOCK AT TIDE-WATER.
The following table shows the outputs for each month during three years, together with the tidewater stock on the 30th of each month (in tons of 2,240 lbs.):

	1889.		1890.		1891.	
	Shipments.	Stocks.	Shipments.	Stocks.	Shipments.	Stocks.
January	2,622,529	807,314	2,281,579	1,138,927	3,138,961	637,688
February	2,097,662	837,216	1,857,452	1,148,380	2,377,208	841,682
March	2,103,062	898,783	2,105,461	992,369	2,515,459	784,587
April	2,274,199	964,628	2,579,47	827,424	2,813,693	711,571
May	3,016,531	932,063	3,036,551	719,939	3,339,534	632,874
June	3,033,216	833,764	3,445,562	720,506	3,780,242	673,144
July	3,627,523	788,069	3,310,074	751,231	3,791,338	703,634
August	3,624,683	795,747	3,291,651	760,811	3,146,434	648,900
September	3,186,883	877,237	3,428,079	676,318	3,333,403	568,833
October	3,711,870	704,909	3,892,716	632,498	4,496,534	635,446
November	3,372,814	771,334	3,501,487	608,479	4,127,567	637,846
December	3,200,000	800,000	3,065,206	535,652	3,554,542	637,846
Total	35,871,972		35,855,169		40,414,995	

THE COAL TRADE IN 1891; VIEWS OF JOHN C. HADDOCK.

The condition of anthracite trade for 1891 has revealed conspicuously the failure of the frequent attempts to regulate production and prices by the larger mining and carrying companies. It is not my present purpose to inquire as to the wisdom or legality of the "arrangement" or "combination" to control price and product. Judging the companies by their own standard—the agreed upon tonnage to be mined and the prices to be obtained—we can measure the difference between promise and performance by the actual condition of the market. It is my conviction that if there is to be a successful attempt on the part of the anthracite companies to regulate the market there must be a closer unification of all interests and it must carry with it a willingness to guarantee the price of coal to the buyer. Such a guarantee would be the conclusive evidence that each company had not only faith in its own promise, but had faith as well in the promise of every other company to the compact. Until that is done I imagine that the buyers of anthracite will exact a discount from the agreed upon schedule of prices to cover the risk they run in assuming that the allied companies will keep agreements made with each other.

Some years ago, in the early spring, in company with my former employer and then partner, the late Mr. Bradford of Newport, R. I., I called upon Mr. Gowen to arrange for the purchase of a comparatively large quantity of coal. The anthracite companies had entered into an agreement to regulate the tonnage and prices for that year, (I think it was in 1878), and the percentage of coal to be mined by each interest had been fully agreed upon, prices had been announced, and we were assured that there would be a constant advance in prices from the spring circular to the fall or winter months. At that time there was, apparently, no obstacle in the way of the companies securing all the results indicated by the agreement of the combination. However, I wished to know of Mr.

Gowen, in the event of our purchasing our stock there and then, if his company would be willing to guarantee that the prices then ruling, and which we were quite willing to pay, would be the lowest price of the season, and if after the delivery the company would make good any loss we might suffer should there be a break in the market. "Ah," said he, "Mr. Haddock, it would not be business for us to give such a guarantee." "But," said I, "if you have absolute confidence in the ability and willingness of the anthracite companies to control price and output, why not put it to the test by protecting us in any purchase we may make?" He replied: "It may be business for you to require such a guarantee, under the circumstances, but looking at it from my standpoint, I can not do it." It is needless to say we did not buy the coal at that time. During the summer, agreements were violated, prices were cut, the market slumped; but that was not the fault of Mr. Gowen. If the good faith of the companies is to be an important factor in maintaining prices, then it is quite important that there should be some way for the buyer of anthracite to put it to a reasonable and satisfactory test. It may be asked, What relation does the individual operator sustain to all this? But as Rudyard Kipling says, that is another story.

THE BITUMINOUS COAL MARKET IN 1891.

The Eastern bituminous coal trade has been satisfactory to the majority of producers and consumers, and to the railroad companies directly interested. The market has been steady at fair and sustained prices, from which the operator has derived a margin of profit, the railroad company an advance of from 15 to 25c. per ton over the previous year's freight rates while the consumer, owing to the stability in prices, has been able to make business arrangements with safety. The year opened with a scarcity of coal at Maryland and Virginia ports, due to the storm blockaded condition of railroads, but this was of short duration. Extra efforts on the part of the railroads, and a bettering of meteorological conditions brought, within a month, a surfeit of coal to market. During February it was announced semi-officially that the railroads would demand an advance over the previous year's freight rates; the Connellsville strike began; the labor agitators in the Clearfield region became aggressive, and the Seaboard Steam Coal Association was formed. None of these events had the effect of inspiring the consumer with any confidence in the stability of the market, and contracts were delayed beyond their usual dates in all quarters. The Clearfield miners postponed their threatened strike until May 1st, and on that date, after failing to draw their brothers of the Cumberland region into it, they gave up the movement altogether. The Connellsville strike was one of the most bitter in the history of the coal trade, and ended about the middle of April in a complete victory for the operators, who made a counter demand of 10% reduction, against the laborers' demand of a 10% advance in wages.

The Seaboard Steam Coal Association, whose role in the past has been remarkable chiefly for the severe penalty it decreed but never enforced against its members who cut prices, after a year of innocuous desuetude, of as revived. It "reaffirmed" its former principles, and was bound to maintain prices by agreement. It provided on paper for a restriction on output to the figures shown by the returns of 1890. The articles governing its existence are those ironclad stipulations of the 1889 organization with a few amendments. The salient points were as follows:

The association shall continue to exist from the first day of March, 1891, forever; but any member can withdraw at the end of the coal year on a written notice of 90 days. No company is to ship coal from the mines by all-rail routes to Connecticut, Rhode Island or that section of Western Massachusetts bounded on the east by Middlesex, Norfolk and Bristol counties. The governing committee shall consist of nine members, a commissioner and a secretary. It is within the province of the governing committee to establish coal prices, and change the same from time to time within its discretion. It shall hold monthly meetings, and have general charge of all the business of the association. A deposit of 10c. per ton per month upon coal shipped during the previous month is required in three monthly installments; the fourth deposit liberating the first.

The association claims to have a supervision over the action of its members, and its articles stipulate that it shall be the privilege of a member to complain, and the duty of a commissioner properly to investigate all complaints. This supervision extends to the subject of prices and output. Coal must be sold free on board, except to the trade in the harbor of New York, and all-rail coal in New England, where delivery prices shall be permitted. No commission over 10c. per long ton shall be allowed. No winter freight shall be, either directly or indirectly, guaranteed by the seller or his representative. The usual terms of payment prevail, i. e., 30 days cash. The shipments of coal counted in this allotment is that which goes outside of the Delaware Capes and Chesapeake Capes, and all the shipments made from the New York harbor shipping points. All-rail coal except that shipped to the New England states is not counted f. o. b. at Philadelphia, Norfolk, Newport News, Baltimore, Georgetown. Under the terms of the agreement prices are to rule as follows—f. o. b. at Philadelphia, Norfolk, Newport News, Baltimore and Georgetown, \$2.50 per ton of 2,240 lbs.:

F. o. b. at South Amboy, Perth Amboy, Jersey City, Weehawken, Hoboken, Harsimus and Port Liberty, for shipments to points outside of the harbor of New York, and also destined to points on the Hudson River, north of Fifty-seventh street, and to points on the East River east of Hell Gate, \$3.07 1/2 per ton of 2,240 lbs.

F. o. b. at Elizabethport and Port Johnson for shipments to points on the Hudson River north of Fifty Seventh street, and to points on the East River east of Hell Gate, \$3 per ton of 2,240 lbs.

F. o. b. at South Amboy, Perth Amboy, Elizabethport, Port Johnson, Jersey City, Weehawken, Hoboken, Harsimus and Port Liberty, for shipments to points on the North River south of Fifty-seventh street, and to points on the East River east of Hell Gate \$3.10 per ton of 2,240 lbs., but also sales made as delivered alongside in the harbor of New York, south of Fifty-seventh street, North River, and on the East River west of Hell Gate, shall not be less than \$3.25 per ton of 2,240 lbs., so delivered.

No coal shall be sold and no contracts be made by any member of the association, or by any agent of any member, at any price which shall include the delivery of the coal to any point other than the shipping port

where such coal may be loaded; except only such coal as is sold delivered in the harbor of New York as provided for in the preceding paragraph. The percentages allotted to the various regions, together with those operative in 1888 and 1889, were as follows:

Table with 4 columns: Region, 1888, 1889, 1891. Rows include Cumberland, Md., Clearfield, Pa., Pocahontas, Va., N. & W. R. R., New River, West Va., C. & O. R. R., Beech Creek, Pa., West Virginia Central R., and Reynoldsville, Pa.

*No organization in 1890. †Clearfield, 32.25%. Cumberland, 27%. There is, however, some dispute as to these exact proportions.

Almost all elements of the trade entered into the agreement upon the platform: "We will stand by the association as long as it stands by us."

Operators now ready for business were compelled to await the pleasure of the railroads in establishing freight rates. A few succeeded in convincing a limited number of customers that a certain definite advance would be made, and secured a few contracts on that basis. Freight rates were fixed at an advance of from 15 to 25c., to take effect April 1st. Even then many withheld orders for futures, believing that the increase would not be maintained.

The Seaboard Steam Coal Association has been largely responsible for this excellent state of affairs. From the start it and a good demand for consumption, induced a belief that prices would be sufficiently permanent to justify trade engagements, and though some few producers, as usual, indulged in the pernicious practice of cutting rates, they have been chief losers.

So good has been the demand for coal that the majority of the companies have overshipped their proportional allotments without protest from the others, for the demand warranted this action and the product was marketed at full rates. In fact, a demand exceeding productive capacity was again shown to be the only safe foundation for a successful combination.

though there have been periods of marked inadequacy in transportation facilities; but at no time have they been of long duration, and no worse than, if as bad as, in former years.

A feature of the year's trade has been the exceedingly low ocean freights which ruled during the summer and fall. Inasmuch as coal has been sold alongside at tide water, the consumer has had the advantage of this. In August 50c. ruled from lower ports to Boston. Up to December rates were low and weak; the cause ascribed was the excessive tonnage in the business, consisting of a number of 2,000-ton steam colliers. In November vesselmen decided to tie up rather than to operate at the ruinously low rates, and did so with the result of a reaction in their favor.

While the production has been heavy, it has all gone into consumption, which has increased materially in a year, proving that there is a growing demand for bituminous coal. There has been but little effort made to enlarge the tidewater trade by the acquisition of new markets, although it is probable that the new commercial treaties with the Latin American States will permit of this.

VIEW OF CASTNER & CURRAN.

The Seaboard Steam Coal Association has proved of great value to the bituminous trade this season, as its prices have been lived up to by the Pocahontas Coal Company, Chesapeake & Ohio Company, and, as far as we are aware, all the Cumberland shippers. In consequence of which these parties have certainly netted about 20 to 25c a ton more than they received last year.

PRODUCTION OF COAL AND COKE IN THE POCAHONTAS REGION.

Table with 6 columns: Year, Coal, Coke, Year, Coal, Coke. Rows for years 1882, 1883, 1884, 1885, 1886.

*The latter half of December estimated.

at very much less than the association prices. The Clearfield shippers, over the Pennsylvania Railroad, foolishly broke their prices early in the season, and, consequently, all the Clearfield shippers (both Pennsylvania and Beech Creek) have thrown away the advance in price which was obtained by the other districts. To cut the established prices as they have done they undoubtedly received a cut in tolls from their respective rail-

ACTUAL SELLING PRICES OF CUMBERLAND COAL FROM 1864 TO DATE.

The following table shows the selling prices of Cumberland bituminous coals on the first of each quarter over a range of years. Up to 1882 the first quotations are upon tonnage delivered at Georgetown, D. C., or Baltimore, Md., to which is to be added the second quotation, or the freight to New York. Since that date the quotations are for coal delivered in New York:

Large table showing selling prices of Cumberland bituminous coals from 1864 to 1901. Columns represent years and quarters (January 1st, April 1st, July 1st, October 1st).

* Delivery at Baltimore. † Delivery at Georgetown. ‡ Delivery at New York.

AVERAGE PRICES OF CUMBERLAND COAL, F. O. B. BALTIMORE, MD., TOGETHER WITH THE AVERAGE FREIGHT TO BOSTON. For ton of 240 lbs.

Table showing average prices of Cumberland coal from 1853 to 1889. Columns include Year, and months from January to December, plus Average for Year and Avg. Freight to Boston.

road companies. Had the Beech Creek and Pennsylvania Clearfield shippers held to the pool prices, they and their railroads would be able to show a very much more handsome profit than they are able to do.

The year has been, on the whole, very satisfactory to the companies maintaining prices, notwithstanding this fact; they have been able to increase their sales, and their respective railroad companies have shared in the advance. We believe the experience of this year has convinced the trade that it is best for all parties to establish fair remunerative prices and hold to them. By cutting, shippers are apt to cause consumers to believe they handle inferior coal which can only be sold at a cut figure. We should think this year's experience would make the Pennsylvania and Beech Creek railroads realize that it is policy for them to adhere to the tolls agreed on by the other companies.

VIEW OF WM. D. KELLY, PRESIDENT CLEARFIELD BITUMINOUS COAL CO.

The bituminous coal trade for the year just closed has been conducted with some special features of interest. The competition between the several regions has been healthful, and a large tonnage has been placed at fairly remunerative prices. The railroads have consumed their usual quantity; New England and the Southern States have taken a large tonnage, while the iron industry has not consumed as much as in 1890. Water rates from Philadelphia, Baltimore and Norfolk to the East have been exceptionally low throughout the season, and many orders have been attracted thereby, that would ordinarily have been shipped all rail from the mines—a condition that evidently was not contemplated when the rail rates were advanced in the spring.

The consumption of coal by the foreign steamships is an important factor in the bituminous seaboard trade, and it may be an interesting question for advocates of the McKinley bill to consider its relation to inferior industries. Many of the vessels coming to this country for our products are bringing sufficient coal as ballast to carry them back, owing

to the comparatively small quantity of freight now offered from England to America.

The outlook for our home trade promises well for 1892. Our railroads have enormous quantities of freight in sight. Indications point to a better demand from the iron districts, and we may expect all classes of manufactures to be reasonably active. Our usual production will thus be absorbed.

For any material expansion of the bituminous business we must seek foreign markets. The West Indies and Mexico especially invite the attention of the trade at this time. New channels of commerce to these countries are being opened, and it is for the aggressive ones to develop a greater demand for our coals than now exists. South America is also a large consumer of coal, which is now supplied by Great Britain, and which it is to be hoped, will in the near future, to a considerable extent, be supplied from this country.

VIEWES OF H. B. NEEDHAM, SECRETARY OF THE MARYLAND COAL COMPANY.

The Eastern bituminous coal trade may be said to have been successful during 1891 on account of favorable weather. January started in with an active demand and a limited stock. These conditions, together with a short supply of cars, rendered the operators in some instances unable to supply their contracts, thereby compelling consumers who had not contracted, to buy at advanced prices. To complicate the situation the railroads over which the coal was transported were compelled to appropriate for their own consumption, to a considerable extent, shipments to tide water. This demand, with the increased supply of cars which came after the lapse of a few weeks was productive of an increased output from the mines, which somewhat relieved the market.

The making of contracts was delayed later than usual by the tardiness of main line roads in using through rates, and by reports of an advance. However, as soon as the tariffs were published the coal trade went to work with a will and all operators apparently took their fair share of contracts. The Seaboard Steam Coal Association coming forward at this time exercised a good moral effect in helping to maintain the market.

From the date of making contracts up to the present time there has been a good, steady business, large tonnage being the rule.

A point worthy of remark is the particularly low rate of ocean freight, from the lower snipping ports, which have ruled. At one period charters were made as low as 50c.

There have been no serious labor difficulties during the year. The agitators endeavored to incite a strike, to occur May 1st in all the regions but from lack of support from the men, who found themselves earning fair wages, no disturbance occurred. The year will be a noteworthy one because of the large amount of coal mined in all regions.

THE OUTPUT OF BITUMINOUS COAL FROM THE CUMBERLAND REGION FROM 1842 TO 1891 INCLUSIVE.

	Tot'l by Balt. O. R. R. & Local.	Tot'l by Che. & O. Canals.	Tot'l by Penn. R. R.	Aggregate.
	Tons.	Tons.	Tons.	Tons.
1842	1,708			1,708
1843	10,982			10,982
1844	14,890			14,890
1845	24,653			24,653
1846	29,795			29,795
1847	52,910			52,910
1848	79,571			79,571
1849	142,449			142,449
1850	192,806	4,014		196,848
1851	174,701	82,978		257,679
1852	268,459	63,719		334,178
1853	376,219	157,760		533,979
1854	533,836	155,845		689,681
1855	478,486	183,786		662,272
1856	592,330	204,120		796,450
1857	465,912	116,374		582,286
1858	385,405	231,251		616,656
1859	426,512	297,842		724,354
1860	443,031	298,878		741,909
1861	172,975	97,593		270,568
1862	218,950	98,654		317,604
1863	531,553	216,792		748,345
1864	399,354	268,612		667,966
1865	560,293	343,202		903,495
1866	736,153	343,178		1,079,331
1867	735,659	481,153		1,216,812
1868	848,118	482,325		1,330,443
1869	1,240,518	652,151		1,892,669
1870	1,112,338	391,137		1,503,475
1871	1,434,811	359,339		1,794,150
1872	1,511,247	816,133	22,021	2,349,401
1873	1,759,710	778,801	114,581	2,653,092
1874	1,576,160	767,064	67,671	2,410,895
1875	1,392,237	879,833	169,698	2,441,768
1876	1,070,775	632,140	131,866	1,834,781
1877	818,459	584,996	170,834	1,574,289
1878	924,254	609,204	145,894	1,679,352
1879	1,075,198	501,247	154,264	1,730,709
1880	1,349,589	603,125	213,116	2,165,830
1881	1,478,562	501,318	278,598	2,258,478
1882	1,085,249	269,782	185,435	1,540,466
1883	1,414,766	680,119	419,288	2,514,173
1884	2,233,028	311,954	356,097	2,901,089
1885	2,076,485	368,744	420,745	2,865,974
1886	2,069,774	232,802	239,891	2,542,467
1887	2,724,247	262,345	389,104	3,375,796
1888	2,639,216	286,700	715,151	3,641,067
1889	2,337,585	57,459	793,842	3,188,886
1890	*2,723,311		1,282,748	4,006,059
1891				

*Includes 95,733 tons used on line of Cumberland & Pennsylvania R. R., and its branches, and at Cumberland and Piedmont; also 449,268 tons used by the Balt. & Ohio R. R. Company in locomotives, rolling mills, etc. †December estimated.

VIEWES OF MR. C. J. WITTENBERG.

The year just passed has been a remarkable one to the bituminous coal trade from the fact that that its events have been so different than those of any other year, with apparently the same results. In the early part of January the general officials of all the roads carrying bituminous coal to tide water points agreed upon a schedule, claiming that they would not allow the sales agents of the coal companies to make arrangements similar to those which had heretofore always been broken. Notice was given to the coal companies that the freight tariffs as printed would be rigidly enforced, and railroad companies owning and operating coal mines were informed that they must live up to the agreement. The formal arrangements were conducted by the Seaboard Coal Association, which started out with flattering promises and a good intentioned organization. Unfortunately, however, the association was short lived, and its dissolution has brought on a more serious demoralization of prices than has ever before been known by the tide water coal trade. The Pennsylvania Railroad Company is probably the only one that has adhered to its freight tariff, though this has had little effect in maintaining prices, for the coal companies have drawn on their own capital to make good the losses they incurred in selling coal to meet the competition of roads offering their shippers a lower freight rate. The published tariff of the Pennsylvania Railroad Company in comparison with the prices at which other shippers have sold their coal would, if the regular tariff is charged them, show a price for the coal of less than 50c. per gross ton, on board cars at the mines. Large losses on every ton of coal sold, may be made possible by large capitals for a period of time, but no capital is large enough to continue this indefinitely.

In May, a general strike was ordered for the Clearfield and Mountain districts, with the understanding that it was to proceed into the Cumberland regions. It turned out to be a newspaper strike existing in name only, but it had the effect of inducing many purchasers of coal to take in such large stocks as would carry them for several months. A natural depression in the coal trade followed, from which it did not recover before the middle of December. This depression has had the effect of leaving the market, even with its increased consumption, with sufficient cars to serve it at all times. It is remarkable that notwithstanding that the railroads have been liberal in the use of freight cars no inconvenience was caused during the entire year, by any shortage thereof.

The reciprocity treaties consummated with South American countries during the past year have made it possible for shippers of general merchandise from this country to negotiate business with our South American neighbors which will eventually enable many freighting vessels to ply between our ports and theirs. This will mean a new opening for our coal, especially for bituminous, from the coal depots of New York, Philadelphia and Baltimore, at which ports the South American trade is most likely to concentrate. The American coal, if properly introduced in South and Central America, will by its cheapness and high steaming qualities, eventually supplant the Cardiff coals, which are about the only kinds now used there.

THE BUFFALO COAL TRADE IN 1891.

(From Our Special Correspondent.)

The anthracite coal trade of Buffalo for the season of 1891, so far as the volume of business was concerned, was generally satisfactory, but from a monetary point of view was not good. The West was made a dumping ground for the large quantity of coal mined during the early part of the year. The tariff from the Lehigh district was made the same as from the Wyoming district by the Lehigh Valley Railroad Company, thereby enabling the Lehigh operators to place their chestnut coal in the Western market on the same freight as the Wyoming coals. The Ontario & Western Railroad Company was also a strong competitor for business in the West during the past season.

Jobbers and individual operators to some extent were enabled to place their product, for the reason that during spasmodic periods the large companies maintained a price for their coal which the jobbers could and did cut. There probably never was so favorable a prospect of good prices for anthracite coal as in the spring, but the large outputs of May and June altered the situation. The improved business outlook in consequence of the enormous crops which were in sight in July and the realized fact in September helped materially to carry the general coal market along, and the hope for a cold winter and the realization of that hope may probably bridge the same over, in fair condition, from now until next May.

The local retail coal exchange is in a very good shape, and works satisfactorily to the dealers, keeping the retail prices at a point where consumers can not complain.

The outlook for the future of the anthracite coal trade is bad; there is an apparent lack of knowledge of the general condition of affairs, or a disregard of all business law and rules by the managers, and the product of the mines is being put on the market much faster than it can be taken care of, and the result is that actual prices are dropping from day to day.

Generally speaking, the supply of cars has been adequate to the demand, although at times some complaints were heard and some shippers were embarrassed temporarily. The supply of cars has been more regular than in former years, certainly due to the enforcement of the car service rules, as well as to the increased equipment of the coal carrying railroads.

There can be no doubt that the introduction of natural gas in Buffalo has had a bad effect upon the coal trade; as a very large section of the city is now supplied with this product from Pennsylvania and Canada, bituminous and anthracite coal is displaced in proportion. The prospects are that next year will see further territory subject to this modern innovation, for persons once using natural gas are loath to give it up and those that have it not are envious of their neighbors who have it. Several dealers in coal have left the business, and many more will follow suit shortly.

A large supply of natural gas has been received by pipe lines under Niagara River from Canada, about 12 miles from Buffalo, during the year, and the supply from this source at present is very large. Numerous wells have been, and are being, drilled in Buffalo and the outlying towns in Erie County, but the success of these, at present writing, has not been very encouraging.

Lake navigation opened April 12th, as far as vessels leaving were concerned, and closed nominally on December 15th, although a few propellers were yet on the lakes at that date.

The shipping docks, trestles, and coal pockets of this port are very extensive. The improvements and enlargements, commenced late in 1890, have all been completed. A close estimate shows the capacity of the pockets to be 360,000 tons, and daily shipping capacity therefrom the same.

The receipts of coal at this port by the Erie canal in 1891 were only 817 tons of anthracite, a large decrease from those of 1890; the shipments of bituminous coal were 34,058 tons, an increase of 8,186 tons. The lake shipments westward aggregated about 2,450,000 tons of anthracite, a small increase over 1890. The railroad receipts and shipment statistics have not been compiled yet, but the figures will be approximately as follows: Receipts of anthracite, 4,500,000 tons; of Blossburg, 25,000 tons, and of bituminous, 2,200,000 tons. The shipments are never reported. No coal has been received by lake for several years past.

Lake freights hence to Chicago and Milwaukee opened at 60c., declined to 50c., then to 40c., and advanced again to 50c., 60c., and 75c.; the average rate was 54c. Freights to Duluth and Lake Superior ports opened at 40c., declined to 30c., advanced to 40c., then declined to 30c., and 25c., and closed from the 10th of November at 10c.; the average rate for the season was 40c. To Toledo and Detroit 30c., 25c. and 20c. was quoted. The freight by lake on coal depends mainly upon two factors, viz: the down rate on grain from Lake Michigan and Lake Superior ports and the demand for vessels for ore and lumber cargoes. The tonnage of the lakes has greatly increased of late years, principally in propellers and barges of large capacity.

A rough estimate of the anthracite coal distribution from this port by vessels westward in 1891 to principal points is as follows: To Chicago, 1,000,000 tons; to Milwaukee, 575,000 tons; to Toledo, 66,000 tons; to Duluth, 253,000 tons; to Green Bay, 27,000 tons; to Saginaw, 22,000 tons; to Detroit, 24,000 tons; to Gladstone, 30,000 tons; to Sheboygan, 17,000 tons; to Superior, 162,000 tons; to Racine, 40,000 tons; to Ashland, 12,000 tons; to Bay City, 11,000 tons; to Washburn, 6,000 tons; to Port Arthur, 2,700 tons; to Menominee, 8,000 tons; to Fort William, 22,000 tons; to Marquette, 18,000 tons, and to Lake Linden, Manitowoc, Sault Ste. Marie, Hancock, and Houghton, from 3,000 to 4,000 tons each.

The prices of anthracite coal in 1891 were as follows: Opened January 1st to dealers on cars at Buffalo, or at International and Suspension bridges, for shipment west per 2,240 lbs. at \$4.75 for grate, \$5 for egg, and \$5 for stove and chestnut; declined June 1st to \$4.39 for grate and \$4.40 for egg, stove and chestnut; advanced July 1st to \$4.40 for grate and \$1.50 for egg, stove and chestnut; and from September 1st to the close of the year ruled at \$4.50 for grate and \$4.60 for egg, stove and chestnut. For coal free on board vessels at Buffalo per 2,240 lbs., the opening rate was: April 22d, \$4.45 for grate and \$4.55 for egg, stove and chestnut; advanced June 1st to \$4.60 for grate and \$4.70 for egg, stove and chestnut; advanced July 1st to \$4.70 for grate and \$4.80 for egg, stove and chestnut; and from September 1st to close of year ruled at \$4.80 for grate and \$4.90 for egg, stove and chestnut. The retail prices per ton of 2,000 lbs. delivered screened in city were: January 1st, \$4.75 for grate and \$5 for egg, stove and chestnut; declined May 1st to 4 50 for grate, egg, stove and chestnut; advanced June 1st to \$4.75 for grate, egg, stove and chestnut, and from October 1st to the close of the year, \$5 for grate, egg, stove and chestnut; but pea size was uniform at \$3.75 and Blossburg at \$4 throughout the year. The range of prices for bituminous coal during 1891 delivered to manufacturers, gas works, propellers and tugs was from \$2 to \$2.75 per net ton in car lots, according to where mined; choice, for family use, about \$6 per net ton delivered in city. About 275,000 tons of anthracite and 3,000 tons of bituminous coal were consumed by families.

The bituminous coal trade of Buffalo for 1891 was not up to the expectations formed by dealers in the early part of the year, but on the whole trade was good for manufacturing purposes; propellers and tugs were larger consumers and for ordinary gas purposes the demand was fairly active. As usual the market closes quiet, as navigation has practically ceased. Manufacturers are running their establishments full time, and every day new concerns are being added to our industries requiring steam. As a coal dealer said recently, "Consumption by manufacturing concerns is steadily on the increase, although the introduction of natural gas affects trade to some extent." The prospects for the coming year are good, predicated on the general prosperity of the country and the large crops of last season. There is no reason now apparent to expect any other condition of affairs.

Stocks here are light, as cars come in from day to day, and contents are sold quickly to escape car service demurrage charges. The effect of the car service rules on the coal trade has proved beneficial, for the reason that cars are more plenty and dealers do not bring coal here without reasonable expectation of making quick sales; so no stocks accumulate, thereby preventing large blocks being thrown on the market and thus demoralizing prices.

The principal strike during the year affecting the Buffalo trade was that of the Pittsburg region in the early fall; but, on the whole, our market was not inconvenienced to any extent, as supplies were obtained from other sources to take its place. Prices slightly advanced for the time being, however, but, taking the average of the year, quotations have been very uniform.

THE CHICAGO COAL MARKET IN 1891.

(From Our Special Correspondent.)

The stocks of anthracite on dock and in yards were less in January, 1891, than they were in January, 1890, and only the prevalence of very mild weather during mid-winter prevented an advance, or at least the maintenance of circular rates. Owing to conditions stated, rates were a go-as-you-please arrangement while demand was entirely governed by climatic conditions. Outside points dependent on this market for supplies made very high requisitions, and buying generally was of a hand-to-mouth character, depending entirely upon the rise or fall of the mercury. A second mild winter was a dampener on the anticipations which had been formed earlier in the season. Operators originated a restrictive policy, which gave life to the hope that it would be fully carried out to the betterment of prices in the fall. That it was not adhered to is a mat-

ter of record and the low prices, which are still quoted, are the result. Shipments commenced early, and heavy stocks were laid in for the season. Vessel coal was shipped until well into December, and many boats now tied up in the river will not be unloaded until the end of the month, as the docks are crowded to repletion. During the early fall buyers and dealers displayed much conservatism in placing orders and contracts. Owing to large stocks they knew they could obtain desired amounts from this distributing center without having to pay an advance.

Trade generally throughout the season has been of a disappointing character, owing almost entirely to the excessive production and enormous stock of coal thrown on the Chicago market. From present indications it will continue depressed until spring, unless abnormally cold weather rules during the remainder of the season. The stock on hand is more than ample for all requirements. The advances made by the Western selling agents located in the East have been more or less of a farce, as the trade has, to all intents and purposes, governed prices in its own market.

In January the soft coal market conditions were in better shape than those of anthracite. Nevertheless the demand was light from mercantile and industrial sources. Conditions were affected only by the weather, as the supply was at all times abundant. Indeed, stocks at one period early in the year were such that a general strike or a shut down for a week would have been a welcome relief. The situation continued much the same, with prices dragging along the bottom until May, when a strike for advance in wages was ordered in the Brazil block district of Clay County, Ind., spreading to and over a large portion of Illinois. The men were out two weeks, at the end of which time they returned to work at the old rates. I. C. W. miners went out about the same time and resumed at previous scale. These troubles in no wise affected prices excepting to make them a little firmer.

In July there was considerable agitation among western miners on account of the legislation affecting their interests, and some of the mines closed down. Some shortage was noted in Illinois coal at this time. In August a notable shortage of cars from Indiana was reported notwithstanding which there was a superabundance of coal. During September the scarcity of cars was more pronounced, and in October full circular rates were obtained on nearly all bituminous coals, with block Hocking and Pittsburg in strong demand. On October 25th the Brazil district miners demanded an advance to 85c. per ton, and after a few days went out on a strike in direct violation of their contract with operators made last May. The operators were firm in their stand and had the sympathy of the public. During the latter part of November the shortage of coal was such that many industrial works, public schools, etc., were supplied by hand-to-mouth lots. This scarcity lasted but a few days. In no market can there be a sudden stoppage in receipts of 350 to 400 gondola cars a day, each carrying from 20 to 25 tons of coal, without causing serious embarrassment. Many of the railroads centering here were compelled by necessities to confiscate cars of coal for their own use. For about a week Hocking and other good grades of bituminous sold at fancy figures. Even the poorer qualities were eagerly picked up. Many lake steamers were detained in the river awaiting fuel supplies. The situation was probably one of the most trying that local handlers of soft coal ever experienced. Affairs were aggravated by the heavy crop movement, certain of the railroads converting the flat and coal cars into box cars for the purpose of carrying grain. Then came the heavy blockade on Eastern lines, and the holding of cars for use in the grain traffic between lake ports and the Atlantic seaboard. There is now an ample supply of coal at this point. Excepting the period just described, prices on all soft coal have varied little from present quotations.

The coke trade opened very inauspiciously in this market, being a little heavy owing to the depression in the iron trade. The largest consumer in the Western States, the Illinois Steel Company, was shut down and did not resume until February. The blowing out of so many Western furnaces lessened the shipments fully 50%. Then came the great strike in the Connellsville (Pa.) coke region, which could not have better suited operators. All the furnaces here had laid in complete supplies to last some time. West Virginia coke was in good demand and made for itself a number of permanent customers, it being used to better advantage than was deemed possible by consumers accustomed to the Connellsville article. It can be laid down here for less money than the Connellsville coke can be. In May the price of coke was placed at \$5.05 f. o. b. Chicago, at which figure it has since remained. Excepting during the mid-summer months the demand has been fair, but during the latter part of the year not at any time active. Crushed coke for domestic purposes is rapidly growing in public favor with increasing sales each season.

PITTSBURG COAL SHIPMENTS IN 1891 AND FOR THE PAST FIVE YEARS.

(From our Special Correspondent.)

The following table gives the monthly shipments of coal by the Ohio River from Pittsburg to Cincinnati, Louisville and New Orleans for the past five years. It will be noted that the shipments for the first four months of 1891, compared with same months of 1890, show a falling off of 30,066,000 bushels. The spring strike, according to these figures, was a costly operation to both sides. In any event the coal run of 1891 will fall a good many million bushels below that of previous years, although the June shipments of the present year were the largest on record, reaching in the aggregate 24,806,000 bushels. The river coal trade of Pittsburg should and would exceed 120,000,000 bushels annually, provided of course there were no strikes or other drawbacks. This amount of coal does not include the railroad coal trade, which aggregates many millions, nor does it include the large amount consumed by the mills and glass factories that are situated at so many points. The diminishing output of natural gas has increased the demand for coal to a wonderful extent. New coal companies are starting up at various points, and thousands of acres of coal lands are being disposed of to new companies. Unless something unexpected should occur, or strikes again intervene, the year of 1892 bids fair to be a big "coal year."

Up to this time the heaviest river shipments were in 1888, when 109,000,000 bushels left Pittsburg by water for the lower ports. The following year, being one of strikes, the shipments fell off 52,809,000 bushels. This

COPPER.

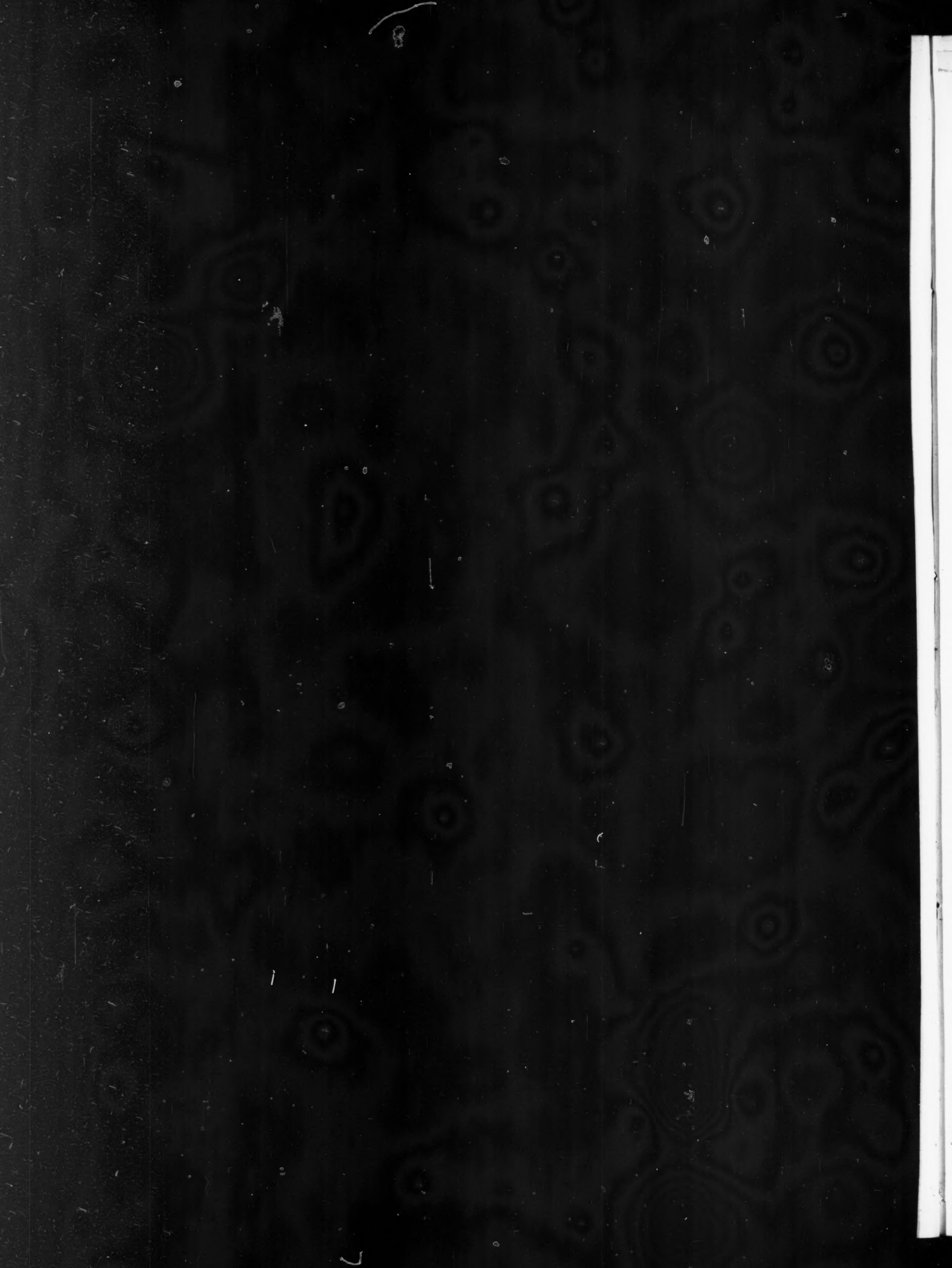
As the United States is the producer of about 44% of the world's supply of copper, the publication of its statistics of production collected at the close of each year by the ENGINEERING AND MINING JOURNAL is the most important event in the copper trade during the year. The amount of copper which our mines have produced, and the stocks of copper, whether in first or second hands, at the close of the year, are indeed important facts to know, and to determine them with accuracy is a great undertaking, involving a vast amount of labor. Only those who have experience in this work can appreciate it from the simple statement that the United States produced in 1891, 298,620,000 pounds, or 133,313 gross tons of copper, that it consumed in that year 216,820,000 pounds, or 96,795 gross tons; exported 110,000,000 pounds, or 49,107 tons, and closed the year with a stock of 76,000,000 pounds, or 33,929 gross tons of copper on hand. Since the world's production of the metal in 1891 was about 300,000 gross tons, the quota contributed by this country was 44% of the total.

In collecting these statistics for 1891 we have also received from each producer the revised figures for his output in 1890. At the same time we have the statement from each producer of his stock (sold or unsold) on hand at the close of 1891, and his corrected statement for stock at the close of 1890.

These precautions, though involving additional trouble to the producers, have rendered our statistics still more valuable by an additional guarantee of accuracy. It is gratifying to know that these revised figures of productions differ only one and three-fourths million pounds from those published in the ENGINEERING AND MINING JOURNAL, January 17th, 1891, page 84.

The amount of copper on hand at the close of 1890 we have had to count by the addition of 22,000,000 lbs., nearly the whole of which was the copper contained in Montana mattes, which through oversight were not included in the stocks last year. This serious error has, of course, induced still more care on our part to secure full returns this year, and as the stocks are much lighter than they were a year ago, the difficulty has been lessened.

From production of copper from both domestic and foreign ores we add to our statistics the stocks on hand at the commencement of the year, and the imports during the year, thus getting a "total available supply" from which we deduct our exports, and the stocks on hand at the close of the year and, by difference, obtain the consumption during the year. The accompanying tables are self explanatory, except as to the increase in stocks, end of December, 1890, as above explained. The production of Lake copper was nearly 16,000,000 pounds greater than in 1890. While the Anaconda mine was closed during seven months of 1891, the increased output of a few of the other Montana mines brought the product of that State above the figures of 1890.



year the railroad miners, notwithstanding the fact that they had signed a contract to continue for a year from May 2d to mine coal for 79 cents per ton, without authority decided to demand 92 cents per ton, which was refused, and a strike was inaugurated on October 1st. The result was that the lake fall trade was lost for the season. After failing to induce the river miners to join them, the strike was finally called off, the coal miners' officials announcing that it had never been authorized any way.

FIVE YEARS' COAL SHIPMENTS BY THE OHIO RIVER.

Table with 6 columns: Year (1887-1891) and 5 rows of monthly coal shipment data in tons.

* Eleven months.

PRODUCTION OF COAL IN THE PRINCIPAL COUNTRIES OF EUROPE IN METRIC TONS OF 2,204 LBS.

Table with 6 columns: Year (1880-1890) and 5 rows of coal production data for Great Britain, Germany, Austria, France, and Belgium.

Increase in Tons and Per Cent.

Table with 6 columns: Period (1880-1890, 1887-1890) and 5 rows of percentage increase data for coal production.

PRODUCTION OF LAKE SUPERIOR COPPER MINES FROM 1855.

Large table with 13 columns (years 1855-1885) and 45 rows of copper production data for various mines and regions.

§ Prior to and including 1860. ° Prior to 1855.

COPPER.

As the United States is the producer of about 43% of the world's supply of copper, the publication of its statistics of production collected at the close of each year by the ENGINEERING AND MINING JOURNAL is the most important event in the copper trade during the year. The amount of copper which our mines have produced, and the stocks of copper, whether in first or second hands, at the close of the year, are indeed important facts to know, and to determine them with accuracy is a great undertaking, involving a vast amount of labor.

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Arizona also increased its output, and promises to keep on doing so through the working of many relatively unimportant deposits rather than through any larger increase from the chief mining.

The copper production of Colorado is increasing and will continue to do so still more rapidly, for many of the lead mines formerly almost free from copper, are finding more and more of this metal as they attain greater depth.

California has increased her output also, but there are reasons to believe that this cannot be maintained during 1892.

The quantity of copper made from foreign ores was much greater in 1891 than ever before. This was partly due to heavier imports from Spain

indicates what our consumption of this metal* may be expected to attain in another decade.

PER CAPITA CONSUMPTION OF COPPER IN THE UNITED STATES.

Table with 4 columns: Year, Population, Consumption in pounds, Consumption per capita. Rows include years 1850 to 1891.

The statistics of foreign production have been collected in many cases, but not in all, so that it is impossible to give the world's production with accuracy, nevertheless it will prove of interest to place on record a few of the returns of production in 1891.

Table listing foreign production locations and their quantities in 1891, such as Newfoundland, Spain, and Venezuela.

PRODUCTION OF THE LAKE SUPERIOR COPPER MINES FROM 1855.

Large table showing production data for various Lake Superior copper mines from 1866 to 1877. Columns represent years and rows represent mine names like Adventure, Etna, Albany & Boston, etc.

(a) May 1st of the following year. (b) Consolidated with the Flint Steel River. (f) Sold to Phenix Company.

and South America and partly to the refining here of a large quantity of Sudbury nickel-copper matte that was brought in 1891, though produced in Canada in 1890.

The exports of copper during the year 1891 were more than twice as large as during the preceding year; in fact, so much copper has been exported that our present stock on hand would suffice for only 4 1/2 months consumption, but as most of this stock is in matte and other forms requiring refining before going into consumption, the available stock would not supply the demand for more than ten weeks.

The consumption of copper in this country during the past year was unexpectedly heavy. The amount used in 1890 in the manufacture of wire was about 42,000,000 pounds, while in 1891 it was not much more than 60% of this amount.

Of electrolytic copper we produced about 30,000,000 pounds, an increase of about 12,000,000 pounds during the year. Electrolytic copper is rapidly taking the place of Lake, and seems likely to make further inroads on that market.

Some of the Lake copper has not been kept up in quality, to the usual standard for that brand, especially in conductivity and this has, no doubt, in part accounted for the relatively low price of Lake, during the past year.

The Canadian nickel-copper producers have not been very active in 1891, owing no doubt to the difficulties experienced by refiners in effecting an economical separation of the metals, but since this appears to be now an accomplished success, and new and larger markets found for the nickel, the large development of these great Canadian deposits may be expected.

At the close of the year the statistical position of copper is very strong, and prices are advancing naturally, because copper cannot be secured at lower rates. Eleven cents may be counted as the bottom price of Lake ingot and 10 1/2, firm, for Baltimore casting hands, as we go to press.

As is usual when any prices of products are unsatisfactory, efforts have been and are still being made to strengthen the copper market by means of a "combination." We have all seen the disastrous outcome of the French syndicate's attempt to corner the copper of the world; that particular plan will of course be avoided, but in every combination or corner to reverse or stem the action of the natural law of "the survival of the fittest" there is implanted at its birth the seeds of dissolution, and so it will prove in this case also.

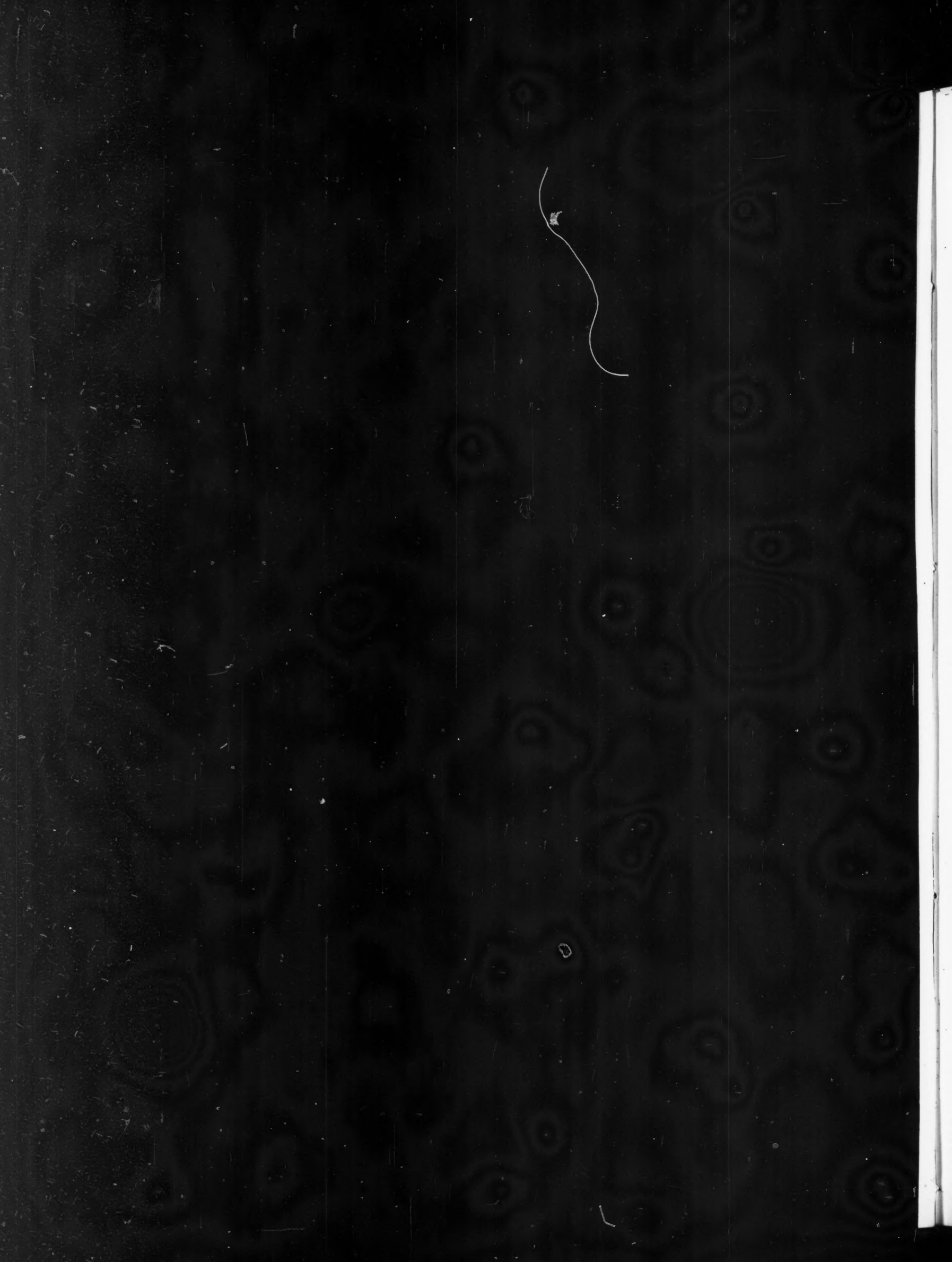
PRODUCTION, CONSUMPTION AND STOCKS OF COPPER IN 1890 AND 1891.

	1890.		1891.	
	Pounds.	Tons of 2,240 lbs	Pounds.	Tons of 2,240 lbs.
Lake Superior.....	99,750,000	44,531	115,370,000	51,505
Arizona.....	34,900,000	15,580	39,700,000	17,723
Montana.....	111,200,000	49,643	113,200,000	50,536
New Mexico.....	870,000	388	1,600,000	714
California.....	1,600,000	714	3,750,000	1,674
Colorado.....	6,000,000	2,679	7,000,000	3,125
Utah.....	600,000	238	1,700,000	759
Eastern and Southern.....	3,900,000	1,741	1,900,000	880
Other sources (Lead smelters). }	6,100,000	2,723	13,500,000	1,563
From foreign ores.....			11,500,000	5,134
Production.....	264,920,000	118,267	298,620,000	133,313
Stocks on hand January 1st..	65,000,000	29,018	101,000,000	45,089
Imports of pigs, bars, etc.....	664,000	296	3,200,000	1,429
Total available supply.....	330,584,000	147,581	402,820,000	179,831
Deduct exports.....	40,000,000	17,837	110,000,000	49,107
" consumption.....	189,584,000	84,635	216,820,000	96,795
Stocks on hand December 31st	101,000,000	45,089	76,000,000	33,929

THE PRODUCTION OF LAKE SUPERIOR COPPER MINES.

	1890.	1891.		1890.	1891.
Cal. & Hecla.....	58,836,904	65,000,000	Nonesuch.....		
Quincy.....	8,064,253	10,300,000	Isle Royal.....		
Oscoda.....	5,294,792	6,426,740	Minong.....		
Franklin.....	5,638,112	4,253,575	National.....	123,897	10,928
Allouez.....	1,470,828	1,267,000	Minnesota.....		
Atlantic.....	3,619,972	3,648,000	Belt.....		
Pewabic.....			Sheldon & Columbia.....		
Central.....	1,413,391	1,329,000	Knowlton.....	23,145	7,120
Grand Portage.....			Adventure.....	15,485	5,600
Lac La Belle.....			Peusinsula.....	1,108,690	1,689,689
Mass.....	60,000	30,114	Tamarack.....	10,106,741	16,199,415
Copper Falls.....	669,000	1,163,000	Ogima.....		
Phoenix.....			Kearsarge.....	1,598,525	1,731,075
Hancock.....			Evergreen Bluff..	15,304	
Huron.....	1,736,777	1,215,734	Centennial.....		435,784
Ridge.....	17,645	43,049	Other mines.....	18,569	50,177
St. Clair.....			Total.....	99,750,000	115,370,000
Cliff.....		303,009			
Wolverine.....					

*Conglomerate



PRODUCTION OF THE LAKE SUPERIOR COPPER MINES FROM 1855.

Table with 12 columns representing years from 1878 to 1889 and rows listing various mines and regions such as Adventure, Albany & Boston, and Total.

(a) May 1st of the following year. (b) Consolidated with the Flint Steel River. (d) Consolidated with the Pittsburg & Boston. (f) Sold to Phoenix Company. (g) No returns. (h) Since 1855.

COPPER PRODUCTION OF THE UNITED STATES. Table with 6 columns for years 1882-1887 and rows for various states and production metrics.

PRODUCTION, CONSUMPTION AND STOCKS OF COPPER IN 1890 AND 1891. Table with 4 columns for years 1890 and 1891 and rows for Lake Superior, Arizona, Montana, etc.

COPPER PRODUCTION OF THE UNITED STATES IN 1888 AND 1889. Table with 2 columns for years 1888 and 1889 and rows for various states and production metrics.

THE PRODUCTION OF LAKE SUPERIOR COPPER MINES. Table with 4 columns for years 1890 and 1891 and rows for various mines like Cal & Hecla, Quincy, etc.

COPPER PRODUCTION OF ARIZONA.

	1885.	1886.	1887.	1888.	1889.	1890.	1891.
Copper Queen...	6,721,535	3,800,000	5,945,550	9,379,949	9,108,000	9,313,680	10,024,608
Holbrook & Cave.				3,042,468	2,561,144	2,925,118	2,730,257
Old Dominion...	4,688,640	4,567,665	1,441,770	1,870,000	5,973,289	7,491,606	7,030,771
Arizona Copper.	6,832,880	5,250,000	5,714,000	7,133,188	7,600,000	4,662,281	6,717,731
Detroit...	3,456,000	2,135,000	4,404,321	5,420,204	5,076,890	4,774,814	4,193,568
Buffalo...			272,124	3,200,000	1,923,738	398,819	2,302,765
United Verde...						5,475,573	6,591,182
Other mines...	1,047,301	247,335	12,235	151,171	440,000	136,779	99,118
Total	22,706,366	16,000,000	17,790,000	33,200,000	32,933,000	34,900,000	29,700,000

COPPER PRODUCTION OF MONTANA.

	1885.	1886.	1887.	1888.	1889.	1890.	1891.
Anaconda...	36,000,000	33,267,861	57,000,000	63,245,473	61,647,000	64,046,812	46,500,000
Parrott...	9,800,000	10,000,000	10,000,000	10,750,000	9,500,000	9,000,000	14,347,191
Bos'n & Mont.	7,500,000	2,000,000	1,500,000	18,278,607			
Clarke & Colusa	10,000,000	7,000,000	7,100,000	700,000	26,125,228	26,912,298	26,786,330
Bu. Red Wks.	2,500,000	7,000,000	1,565,000	3,521,556	2,560,000	3,301,209	3,100,000
Col. S. & M.	1,200,000	2,000,000	1,500,000	1,488,000	2,954,000	3,202,000	3,975,100
Ba. & Boston.					1,103,125	5,485,431	18,131,343
All others...	798,861	1,643,621	31,667	521,295	400,000	200,247	356,730
Total	67,797,864	57,611,485	78,69,687	98,500,000	104,539,353	110,996,000	113,200,000

PRINCIPAL COPPER SUPPLIES OF THE WORLD.†
(In English tons of fine copper.)

COUNTRIES.	1890. 1889. 1888. 1887. 1886. 1885. 1884. 1883.							
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Algiers	120	160	60	150	110	250	200	600
Argentina Republic..	150	190	150	170	180	233	159	233
Australia	7,500	8,300	7,450	7,700	9,700	11,400	14,100	12,000
Austria	1,210	1,225	1,010	883	733	585	670	500
Bolivia	500	*1,200	1,470	*1,300	*1,100	*1,500	*1,500	1,680
Canada	3,050	2,500	*2,250	1,450	1,560	1,200	1,000	1,055
Chili	26,120	24,250	31,240	29,150	35,025	38,590	41,618	41,099
Cape of Good Hope— Cape Copper Co.	5,000	5,600	5,800	5,950	5,390	5,000	5,000	5,000
Namaqua Cop. Co.	1,450	*2,100	1,700	1,300	625	150		
England	*1,000	905	1,456	389	1,471	2,733	3,350	2,620
Germany— Mansfeld	15,800	15,505	13,380	13,025	12,595	12,450	12,582	12,643
Other German	2,000	*1,850	*1,850	*1,870	*2,800	*2,200	*2,000	*2,000
Hungary	*300	300	858	531	305	600	600	790
Italy	3,000	*3,500	3,500	2,500	2,100	*2,000	*2,000	*1,600
Japan	15,000	15,000	11,600	*11,000	*12,000	*10,000	*10,000	*7,600
Mexico— Boleo Co.	3,450	3,280	2,566	1,950				
Other Mexican	875	500	200	100	250	375	291	489
Newfoundland— Betts Cove	735	1,115	1,300	1,180	1,125	778	668	1,053
Tilt Cove	1,000	1,500	750	125				
Norway— Vignaes	925	1,007	1,020	1,150	1,920	2,180	2,390	2,340
Other Norwegian	450	350	300	275	330	380	392	322
Peru	150	275	250	50	75	229	362	395
Russia	4,800	4,070	4,700	5,000	4,875	5,100	4,700	4,400
Sweden	800	830	1,036	905	520	775	682	732
Spain and Portugal— Rio Tinto	*30,000	29,500	28,500	28,500	24,700	23,484	21,564	20,472
Tharsis	*11,000	*11,000	*11,000	*11,000	*11,000	*11,500	*10,800	*9,800
Mason & Barry	*5,600	*5,250	*7,000	*7,000	*7,000	*7,000	*7,500	*8,000
Sevilla	810	1,350	1,700	2,300	2,135	1,800	2,000	2,026
Portuguesa	*1,200	1,200	1,250	*856	1,258	1,665	*2,300	2,257
Other mines	*4,425	*6,500	*7,000	4,050	3,560	2,424	2,251	1,952
Total	53,035	54,800	56,450	53,706	49,653	47,873	46,415	44,607
United States— Lake Superior	44,450	38,769	38,650	33,330	35,590	32,210	30,925	26,650
Montana	49,560	46,618	43,703	35,225	25,720	36,270	19,253	11,010
Arizona	15,915	14,419	14,062	8,035	6,985	10,133	11,925	10,660
Other States	6,370	6,068	5,295	2,519	1,510	1,435	2,585	3,250
Total	116,825	105,774	101,710	79,109	69,805	74,050	64,700	51,570
Venezuela— New Quebrada	5,640	5,563	4,000	2,900	3,708	4,111	4,600	4,018
Total	270,485	261,650	258,026	223,078	217,086	225,592	220,249	199,406
Average prices † Chili bars	£54 1/4	£19 10/6	£22 7/6	£42 3/4	£40 6/8	£44 1/6	£54 15/6	£63 8/9
G. M. B.'s								

* Estimated. † Compiled by Henry R. Merton & Co., London.
‡ On the first of each month.

THE COPPER MARKET IN 1891.

The experience in the copper trade in the year 1891 can almost be summarized in the one word "disappointing." The heavy failures in England in the fall of 1890, and the following panic, left an effect, and the continued troubles in the different South American States made capitalists, especially in Europe, very uneasy, partly crippled them seriously and partly warned them that the utmost caution was necessary. At times during the past year further complications in Europe seemed imminent; when in the fall the Russian Government tried to negotiate a loan in France, and failed ignominiously, catastrophe threatened at any moment and would probably have happened had not the syndicate been relieved, by the Russians, of a portion of the loan. It was also feared early in the year that money would become very dear during the balance thereof, and that this did not happen is evidently due to two factors, viz., that everybody tried to provide for contingencies, and that many of the capitalists rather preferred to lend out money from day to day at cheap rates than to venture into any enterprises. Great hopes had been entertained in this country of the effects of the enormous crops with which the whole United States were blessed; a general boom was expected, and not without reason, but all this failed to come to pass, the untoward influences more than counterbalancing the toward.

It had further been hoped that the expected national prosperity would naturally react on the railroads, and that from their tremendously in-

UNITED STATES COPPER IMPORTS.

Year	Bars, Ingots and pigs.		Old, fit only for remanufacture.		Fine Copper contained in ores.		Regulus and Black Copper	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Lbs.	\$	Lbs.	\$	Lbs.	\$	Lbs.	\$
1867..	1,633,953	\$287,831	551,732	\$81,930		\$936,271		
1868..	61,394	6,935	318,705	42,652	3,496,191			
1869..	13,212	2,143	200,780	34,820	24,350,004			
1870..	5,157	448	255,386	31,931	1,936,875			
1871..	3,316	491	369,433	45,672	411,315			\$60
1872..	2,638,589	578,065	1,144,142	178,536	584,878			4,247
1873..	9,697,608	1,984,122	1,413,010	255,711	702,086			1,444,239
1874..	713,935	134,326	733,326	137,087	606,266			70,433
1875..	58,475	10,741	386,320	55,664	1,337,101			161,903
1876..	5,281	788	239,987	35,545	538,972			68,922
1877..	230	30	219,443	28,608	76,657			9,756
1878..	1		198,749	25,585	87,039			11,785
1879..	2,515	352	112,642	11,597	51,959			6,199
1880..	1,242,103	205,121	695,256	91,234	1,165,283			173,712
1881..	219,802	36,168	511,074	63,383	1,077,217			121,477
1882..	6,200	896	508,901	59,429	1,473,103			117,116
1883..			330,495	36,166	1,115,586			113,339
1884..	(?) 512	107	149,701	12,099	2,204,070			219,957
1885..	814	172	81,312	6,658	3,065,729			343,793
1886..	276	24	37,139	2,407	4,530,100			311,558
1887..	212	40	39,357	2,374	3,806,192			194,785
1888..	1,787	299	37,640	2,733	4,849,812			281,477
1889..	8,160	522	19,912	1,176	3,772,888			274,649
1890..	6,189	859	284,789	26,478	18,448,287			241,732

In this table the figures are for fiscal years ending June 30th, from 1867 to 1885 inclusive, and for calendar years ending December, 1886, forward.

COPPER EXPORTED FROM THE UNITED STATES.

Years.†	Ore.		Pigs, bars, sheets, and old.		Value of manufactured.	Total value.
	Quantity	Value.	Quantity	Value.		
	Cwts., of 112 lbs.	\$	Pounds.	\$		
1867.....	87,731	\$317,791	4,637,867	\$303,048	\$171,062	\$791,901
1868.....	92,612	442,321	1,350,896	327,287	152,201	922,409
1869.....	121,418	337,424	1,133,360	233,932	121,342	532,698
1870.....	*19,198	537,505	2,214,638	385,815	118,926	1,042,216
1871.....	*54,145	727,213	581,650	133,020	55,198	915,431
1872.....	35,561	101,752	267,868	64,844	121,139	287,735
1873.....	45,252	170,365	38,598	10,423	78,288	259,076
1874.....	13,326	110,450	503,160	123,457	23,301	467,208
1875.....	*51,305	729,578	5,123,470	1,042,536	43,12	1,815,296
1876.....	15,301	84,471	14,304,160	3,098,395	343,544	3,526,410
1877.....	21,432	109,451	13,461,553	2,718,213	195,730	3,023,394
1878.....	32,947	169,020	11,297,876	2,102,455	217,416	2,488,921
1879.....	23,070	102,152	17,200,739	2,751,153	79,900	2,933,205
1880.....	21,025	55,763	4,206,258	667,242	126,213	849,218
1881.....	9,058	51,439	4,865,407	786,890	38,036	876,395
1882.....	25,936	89,515	3,340,531	565,295	93,616	745,456
1883.....	112,923	943,771	8,221,363	1,233,947	110,286	2,348,004
1884.....	386,110	2,930,895	17,044,766	2,527,829	137,135	5,595,859
1885.....	432,300	4,739,601	44,731,858	5,539,887	107,536	10,187,024
1886.....	417,520	2,341,				

trade could not fail to influence prices adversely, but the excellent demand which came from Europe, where there was an enormous increase in consumption, helped to keep prices fairly steady for a long period, especially as values had come down to reasonable figures; but what most materially accelerated the decline was the policy of one of the largest producers of copper in this country, which, it calculated to bring down the value of copper to a low point, succeeded most admirably. Whether this action has been a source of rejoicing on the part of the shareholders is another question, but that it was adopted and carried out still remains.

The year opened with the Lake copper companies giving out as their official price 15c., but prior to that Lake copper had been obtainable quite freely at 14½ to 14¾. Consumers being well stocked, however, kept out of the market, and were only too glad to observe the "waiting" policies of the companies, which had meanwhile accumulated heavy stocks, and, in order to relieve themselves, made some contracts for export, the first of which took place in the beginning of February, and was for about 5,000 tons for delivery spread over several months, the price being about 13c. f. o. b. New York. In the beginning of March the price was lowered to 14c., at which figure buyers were found for fair quantities, the stocks in consumers' hands having become greatly diminished. Nevertheless production proved to be larger than consumption, and partly from the smaller companies and partly from second hands the trade continued to be supplied, especially with ingot copper, at about a quarter of a cent less, until in the beginning of May a further decline was established, and 13c. was accepted by the companies generally. Before this decline came a further sale of Calumet & Hecla copper was consummated for export to Europe. The quantity was said to be about 10,000 tons, and while the price was not reported it was estimated to have been about 12½ to 12¾. Shortly afterward the European markets purchased very freely and prices hardened, touching the highest point of the year; but when it became known that the largest lake company was personally soliciting orders from consumers in Europe, demoralization naturally followed and a long continued period of dullness set in. Thirteen cents no longer proved an inducement to home trade, and, values flattening, sales were made right along at gradually falling prices, until in the beginning of August some isolated transactions were consummated at 12c., when, there again being a very good demand, large quantities were taken up by the trade and, with a very good business doing, the market quickly advanced to 12½c., ruling there very steadily until the end of August. Large shipments of Lake copper were being made to Europe continually, and the companies found themselves very busy trying to satisfy the demand. Specifications came in largely for cakes and bars, showing that business in the electrical branches had also increased somewhat, and stocks everywhere dwindled down to quite insignificant quantities.

Before going farther, it is best to look back somewhat and note what happened in other quarters. It will be remembered that during 1890 efforts had been made to float the Anaconda Mining Company in England, and options on the property had been given to some of the most influential capitalists in Europe, who introduced some prominent New York gentlemen into the board of managers. For reasons which have never been explained quite fully it was considered good policy to close down the entire Anaconda mine in March, but a sale of 10,000 tons of matte had been made previously for shipment to England on the average price of G. M. B.'s and best selected copper as ruling in England over a period of 12 months. It was given out that the closing down was solely in consequence of freight differences with some of the Western railroads; and while this, no doubt, played an important part, it was evidently not the only cause of the decision. The sale on average price was evidently made in anticipation that the closing down of this important property for some time would influence favorably the prices of the copper market at large. In this respect, however, the outcome was entirely different from what was hoped for and anticipated. In the meantime the mines of the company were closed down, and the only work done was to get all the material which was above ground into marketable shape. During this time the negotiations to float the company in London had fallen through, and the European capitalists retired entirely from the scheme. The mine was thus left in the hands of the present owners, who, in the beginning of December, voted to increase the capital stock, at present \$12,500,000, to \$25,000,000.

The diminution in supplies of furnace material, with which to make casting copper, consequent upon the closing down of the Anaconda, was felt more severely here than abroad, as whatever the Anaconda produced up to the time of shutting down, and afterward from what was worked up from material above ground, had to be shipped abroad to fill export sales. The supply of casting copper was thus cut down and at the beginning of the year, with Lake actually selling at 14½ to 14¾c., it was quoted at 12 to 12½c., or a difference of 2½ to 2¾c.; but when, by the end of March, the closing down of the Anaconda became known, prices for casting copper immediately advanced, and toward the end of May, after having been selling for the two months previous at 11½ to 11¾c., quotations were raised to 11½ to 11¾c., or a difference of only 1½ to 1¾c. as compared with Lake. This comparative value was not only upheld, but when the price of Lake was fixed at 12½c., nothing was obtainable during the month of September below those figures, and the margin between the two descriptions was thus but 1@¾c. Early in October reports were circulated that the Anaconda Company intended reopening at once, and this depressed the European market very much, prices for G. M. B.'s declining quickly from about £52 10s. to about £50. A few days later those reports were contradicted, and the instructions to commence operations withdrawn, but this was only temporary, and the actual resumption of work took place at the end of October, prices in Europe falling to £44 10s. @ £45. Such a heavy decline abroad could not be without influence on this market, and although the Calumet & Hecla Company steadily refused to break the prices of 12½c., the smaller companies were free sellers, and by the end of October Lake copper was obtainable at about 11¾c., while casting copper held its own, and a little more, at 11½@11¾c.

During November, prices continually declined; much copper was pressed on the market, and stocks accumulating on the Lakes put buyers on their guard. By the middle of November Lake copper could be procured at 11¾c., and with a flat market early December saw 11c. By this time the Calumet & Hecla Company intimated to the larger consumers that it was ready to make a sale and on December 12th a few million pounds,

not by far so large a quantity as was anticipated, were sold at a price of 10½c. basis New York, deliveries to be spread over several months, and buyers then spoke very confidently of expecting to contract for further quantities at 10c.

In the meanwhile the London market exhibited very great strength, and values for speculative copper advanced slightly from day to day, closing at the best on the last day of the month. In the beginning consumers in Europe were rather holding off, but seeing the great strength developing, and being poorly provided for, they purchased rather heavily. After the Calumet & Hecla Company had made its sale at 10½c., the market over here was rather irregular and considerable copper changed hands at 10¾c. and 10½c., the bulk at the latter price. Immediately after the Christmas holidays all these offers were withdrawn, and the principal sellers at the low figures turned around and became buyers. The Calumet & Hecla Company being out of the market, and the smaller companies not being anxious to share in the depressed prices, withheld entirely from the market, and at the close there is a very firm tendency, and we have to quote Lake copper at 10¾c., buyers, and 11c. sellers.

As we had to comment last year on the high prices, we feel it our duty now to do so on the low prices of copper. Ten cents appears to us to be rather below the level to which the value ought to go, as at such a price only a limited quantity can be produced, and not enough by far for the steadily increasing consumption of the world; and if during the last 15 months the trade has had to suffer under a heavy and continued decline, there is now a splendid chance of making up for past losses.

AVERAGE PRICE PER POUND OF LAKE COPPER AT NEW YORK.

Year.	Jan. cts.	Feb. cts.	Mar. cts.	Apr. cts.	May. cts.	June. cts.	July. cts.	Aug. cts.	Sept. cts.	Oct. cts.	Nov. cts.	Dec. cts.	Year. cts.
1860.	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½
1861.	19½	19½	19½	19½	19½	19½	19½	19½	19½	19½	19½	19½	19½
1862.	27½	26½	24	22½	21½	21½	21½	21½	21½	21½	21½	21½	21½
1863.	33	36	34	30½	30½	30½	30½	30½	30½	30½	30½	30½	30½
1864.	40½	41½	42	43½	43½	46½	50½	5 ¼	50	47½	48	48½	48½
1865.	48½	4 ¼	39½	31½	32	29½	29½	3 ¼	31½	32½	39½	42½	36½
1866.	40	36½	25½	29½	29½	32½	3 ¼	30½	31½	30½	28½	27½	31½
1867.	28½	27½	25½	24	24½	24½	24½	24½	24½	24½	24½	24½	24½
1868.	22½	23½	23½	23½	24½	24½	24½	24½	24½	24½	24½	24½	24½
1869.	25	26½	25½	25½	24½	24½	24½	24½	24½	24½	24½	24½	24½
1870.	21½	20½	19½	19½	19	19½	20½	20½	21½	21½	21½	21½	21½
1871.	22½	21½	21½	21½	21½	21½	21½	21½	21½	21½	21½	21½	21½
1872.	27½	28½	33	41½	36½	31½	31½	31½	31½	31½	31½	31½	31½
1873.	34½	34½	34½	34½	31½	29½	27½	27½	26	25½	24½	24½	24½
1874.	24½	24½	24½	24½	24½	24½	24½	24½	24½	24½	24½	24½	24½
1875.	22½	21½	21½	21½	21½	21½	21½	21½	21½	21½	21½	21½	21½
1876.	23½	22½	22	22	21½	20	19½	19	20	20½	20½	20½	20½
1877.	19½	19½	19½	19½	19½	19½	19½	19½	19½	19½	19½	19½	19½
1878.	17½	17½	17	16½	16½	16½	16½	16½	16½	16½	16½	16½	16½
1879.	15½	15½	15½	15½	16	16½	16	16½	16½	16½	16½	16½	16½
1880.	23	24½	23½	21½	19	18½	18½	19	18½	18½	18½	19	20½
1881.	19½	19½	19½	18½	17	16½	16½	16½	16½	16½	16½	16½	16½
1882.	20½	19½	19	18½	18½	18½	18½	18½	18½	18½	18½	18½	18½
1883.	18	17½	17½	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½
1884.	14½	14½	14½	14½	14½	14½	14	13½	13½	13	12½	11½	11½
1885.	11½	11½	11½	11½	11½	11½	11½	11½	11½	11½	11	11	11½
1886.	11½	11½	11½	11½	10½	10	10	10½	10½	10½	12	12	11
1887.	11½	11	10½	10½	10	10	10	10½	10½	10½	12½	11	11½
1888.	16½	16½	16½	16½	16½	16½	16½	16½	16½	16½	16½	16½	16½
1889.	17½	16½	16½	16½	12½	12	12	11	11	12½	14½	13½	13½
1890.	14½	14½	14½	14½	15½	16	16½	17	16½	16½	15½	15½	15½
1891.	14½	14½	14	13½	13½	13	13	12½	12½	12½	11	.....	.....

THE LONDON COPPER MARKET IN 1891.

(From our Special Correspondent.)

The general tendency of the copper market when the New Year opened was dull, both as regards speculation and consumption. Unfavorable statistics contributed to this depression, the figures for the second fortnight of December showing an increase of 1,500 tons in the visible European supply, while stocks in America had increased by about 6,000 tons during 1890. The first movement in G.M.B.'s was consequently a fall from £52 15s. to £51 15s. spot cash; but later in the month (after the publication of the mid-monthly statistics showing a decrease in supplies) the price rose, in the absence of any pressure to sell, to £53 10s. spot cash, which was paid in the last week in January. Before that week closed, however, we witnessed a fresh relapse of about £1, the cause being realizations (including sales of large quantities of matte, and also 3,000 tons of lake copper at 13 cents).

As to refined and manufactured copper, the demand was not brilliant, consumers, in anticipation of increased imports for America, were maintaining, in many cases, a waiting attitude and buying mainly from hand to mouth. India, which had during the last fortnight of December, taken a large quantity of sheets, continued in the market for moderate quantities. The current prices of the various sorts were as follows: Tough, £56 to £57; best selected, £59 to £60; strong sheets, £65 to £66; India sheets, £61; and yellow metal 6d. per lb.

February opened very quiet under the above conditions, raw copper, refined copper and G. M. B.'s being alike devoid of noteworthy feature. In Chili, the political disturbances had already begun to interfere with shipments, and in the absence of any advice of charters, statistics were again favorable, and we witnessed an advance in G. M. B.'s to £53 5s., which was, however, succeeded by a relapse to £52 10s.

Various factors detrimental to the market for consumption were now in operation. The arrivals of American copper were beginning to attract attention, and tended to counteract the good effect of statistics. In sulphate of copper, the overproduction of last year had resulted in a great accumulation of stocks—a malady which had to be met by the drastic remedy of the total abandonment of production in many works and a greatly restricted output in others. In the North of England a little help came to smelters and manufacturers in the shape of cheaper fuel, large contracts for the year being made at 2s. under last year's price. In South Wales, however, and in the adjoining districts, work was considerably hampered by labor disturbances.

March witnessed a backward movement in G. M. B.'s to £51, due mainly to somewhat reckless sales both of G. M. B.'s and of refined copper for consumption which, in their turn, were no doubt induced by the uneasiness prevailing in financial circles. The hostilities in Chili continuing to interfere with charters, the first fortnight of this month showed a decrease in supplies of over 2,000 tons. This, combined with the news

of the stoppage, and probable closure for several months, of the Anaconda mine, gave the market a fillip, and the price rose to £52 17s. 6d.

Early in April, a few buying orders resulted in a further advance to £53 5s., notwithstanding the increase of 1,700 tons in stocks for the second fortnight of March. The general position and outlook of trade were, however, the reverse of reassuring and were rendered worse by the unsettled state of credit in the city and elsewhere. Then there was again an increase, though slight, in the figures for first half of April, and purchases of G. M. B.'s, which were now dear in comparison with refined sorts, were few and unimportant. Thus deprived of support, the value tumbled from £53 5s. to £50 15s., rallying, before the month closed to £51 13s. 9d. upon the strength of a little covering by bears and a few speculative purchases.

May opened rather firmer at £52 5s. but the price was again depressed, viz., by bear operations connected with the weakness manifest on the stock exchanges, especially that of Paris, and receded to £51. The latter half this month was, however, distinguished by a brisk revival of speculative enquiry, stimulated further by the expectation of good statistics and by the purchase by smelters of the entire stock of Anaconda matte in and afloat to England for forward delivery, upon average terms. The purchases made during this spurt in speculation were swelled by a considerable amount of covering by bears afraid of being caught. The net result was a rapid bound in value to £55 2s. 6d.

This vigorous upward movement made further progress in June, after a temporary relapse to £54 10s. (from £55 12s. 6d.), up to £56 10s. paid for spot. This figure formed the culminating point of this advance and also proved to be the highest price attained during the whole year. The movement was ascribed, at least in part, to "bull" operations for account of the holders of large quantities. The month closed with a decline to £55 15s.

Consumers complained of the insufficiency of new orders and demand could certainly only be described as moderate. In India sheets, however, a good business was done during the month at about £62 5s. American copper, the competition of which had been making itself felt in Birmingham, now began to be required at home, where consumers appeared to be running short, and shipments to Europe consequently dwindled gradually down.

July opened with a further relapse to £54 17s. 6d. and a subsequent rally to £55 7s. 6d. The fluctuations during this month were frequent and of considerable extent, but the general trend of values was decidedly toward a lower level, owing mainly to heavy forward sales of G. M. B.'s, including 5,000 to 6,000 tons by a single firm. Unfavorable statistics (1,400 tons increase for the whole month) accentuated the depression, and at length we touched £51 10s., a price nearly £4 below the highest of the month.

At the commencement of August a little spurt in speculative bidding and purchasing, added to a stiffening of the American market, induced a recovery to £53 2s. 6d. at this higher level, however, sellers came out again, with the result that we soon touched £51 18s. 3d. Subsequent fluctuations ranged between £53. 1s. 3d and £52. 6s. 3p; the close being at about £52 15s. The transactions in C.M. B.'s this month again assumed very considerable proportions in contrast with the actual trade for consumption, which remained unsatisfactory.

September was distinguished by a somewhat better demand for refined copper, stimulated by the issue of important orders to northern shipbuilders, and assisted too by the comparatively cheap prices ruling. As to the speculative market, the tone was steadier this month and variations consequently confined within a narrower range, viz. £22 2s. 6d to £53 5d. during netyly the whole of the month; just at the close, however, there came a decline to £51 2s. 6d.

The month of October, in marked contrast to the foregoing month, proved to be a month of excitement and of startling changes in values. Heavy sales were induced by the rumor that the Anaconda mine was about to reopen, and the value of spot G. M. B.'s fell rapidly to £49 15s. The contradiction of the rumor was followed by an equally rapid rally to £51 2s. 6d. In view of the project sale of the Societe des Metaux's works, including large stocks of copper, the operations of a certain clique were said to be directed to depressing the purchase value of the said stocks, which were to be taken over (with the works) at a valuation, and this circumstance, together with fact that the 6,000 tons (about) of G. M. B.'s sold in July, fell due and were delivered during this month depressed the market, which touched £49 13s. 9d. for spot G. M. B.'s. The definite announcement of the resumption of work in the Anaconda mine gave fresh force to the downward movement, and although there was no likelihood of any immediate shipments to this country, the news—coming upon a very sensitive market—sent the G. M. B. value down with a rush from £49 17s. 6d. to £46. As to the Societe's works, the sale was, in the sequel, postponed to December 2d.

As will be easily conceived, the perturbed state of the G. M. B. market was not calculated to inspire consumers with confidence and to encourage them to purchase, and the impression received at the Birmingham quarterly meeting confirmed the general reports of inactive trade and diminished consumption of copper. Statistics told the same tale; the visible supply, which had decreased from 65,366 tons on December 31st, 1890, to 57,325 tons on June 30th, 1891, rose between the latter date and October 31st to 59,815 tons, although the difference was of course partly due to increased supplies (from Chili chiefly).

The unsettled condition of the Bourses formed a leading factor in November; the lack of confidence seemed to be general, and tended to repress and damp the courage of speculators and consumers alike. The Board of Trade returns (issued early in the month) reflected the lessened volume of trade, and moderate sales served to repress the value of G. M. B.'s. (spot) from £46 7s. 6d. to £44 2s. 6d. (so far the lowest point of the year,) with an intervening rally to £46. The fluctuations during the remainder of November ranged between £45 6s. 3d. and £44 5s.

At the commencement of the present month (December) two circumstances combined to exert a favorable influence upon the market. The first was the sale, on December 2d, of the Societe des Metaux's works and stocks, which rid the market of a bugbear and relieved it of one influence, a la baisse. The second was the publication on the same day of the statistics for November, showing an improvement of over 2,000 tons. The effect of these two factors on the G. M. B. market was a rapid

advance to £47 s. c. Consumers were also stimulated by this advance into a somewhat more active demand, which was not, however, sustained. The higher values of G. M. B.'s have brought out more sellers, causing values to give way to some extent. The lowest point touched in the interval is £45 15s., and the highest £46. The final figures at date of writing are £45 17s. 6d. to £46, spot, and £46 10s. to £46 12s. 6d., 3 mos. Refined sorts close at £49 to £49 10s. for tough, £50 10s. to £52 for best selected, £60 for strong sheets, £57 for India sheets, and 5½d. to 5¼d. for yellow metal sheets, 4 ft. x 4 ft.

The general demand for refined copper is steady. Electrolytic copper has sold well and appears to be in great request, owing to the gradual extension of electric lighting. The great exhibition at Frankfurt-on-the-Main is supplying a powerful stimulus to this branch of progress, and the coming year will no doubt witness a rapid increase in the number of installations (the winter being unsuitable for the laying down of mains), and this circumstance can only tell in favor of copper. With regard to refined copper, we may draw attention to what has already been alluded to incidentally, viz., the tendency toward a narrower margin than formerly between the speculative medium G. M. B.'s and refined copper for consumption. This tendency is attributed, in the main, to the lower values of refined English copper induced by the competition of American refined copper, and at times when, in addition to this factor, there has come a spurt in speculation, driving up the G. M. B. value, the margin has been very narrow indeed. The market for raw material is quiet, with few and comparatively unimportant transactions.

In Chili, since the decisive victory of the Parliamentary troops in September, there has been a gradual resumption of work, but labor is very scarce and the latest advices are to the effect that the production is not being augmented, while one of the principal sources of Australian supplies is at present shut off by a strike of considerable dimensions.

The present position of statistics will be seen from the tabular statement appended hereto. It indicates a slight increase, viz., about 400 tons, for the second half of the year, but the total decrease for the whole year is, up to the 30th of November, of 7,646 tons in the visible supply.

EXPORTS OF COPPER, WROUGHT AND UNWROUGHT, FROM GREAT BRITAIN.

Table with 2 columns: Month/Year, Tons. Rows include Eleven months ending November 30th, 1891 (69,596), 1890 (81,850), and 1889 (66,319).

IMPORTS OF COPPER INTO GREAT BRITAIN, JANUARY TO NOVEMBER 30TH.

Table with 3 columns: Month/Year, Tons. Rows include Pyrites, Ores, Regulus, Precipitates (Spain and Portugal), Wrought and unwrought, and Total for 11 mos., 1891, 11 mos., 1890, and 11 mos., 1889.

PRICES OF CHILI BARS IN POUNDS STERLING PER TON OF 2240 LBS.

Large table with 13 columns (St'ks, Jan, Feb, Mar, Apr, May, Jun, July, Aug, Sep, Oct, Nov, Dec, Yr.) and 19 rows of price data from 1866 to 1891.

STATISTICS OF COPPER IN EUROPE. (Compiled by Henry R. Merton & Co.)

Table with 5 columns (1891, 1890, 1889, 1888) and 12 rows of statistics for copper in Europe, including stocks in England and France, Liverpool and Swansea, and afloat from Liverpool to Continent.

Price of Chili bars and G.M. B.'s, per ton. £46 5s. £44 12s. 6d. £57 5s. 6d. £50 2s. 6d. £77 10s. * Charters for second half November estimated at 1,200 tons.

Comparative Statement.

Date	Stock in England and France and amount hereof from Chili and Australia.	Price of G. M. B.	Charters from Chili.	Imports into England, and France from—				Shipments from Australia to London.	Total supplies in England and France.	Deliveries in England and France.
				North America.	Spain and Portugal (excluding pyrites).	Other countries.	Shipments from Australia to London.			
Nov. 30, 1891.....	57,720	44 12 6	2,150	2,067	872	1,825	400	7,254	9,349	
Oct. 31, 1891.....	59,815	46 5	900	1,427	1,734	4,833	800	9,754	9,389	
Sept. 30, 1891.....	59,450	51 2 6	2,950	3,045	2,181	1,975	700	10,851	11,030	
Aug. 31, 1891.....	59,629	52 10	2,300	3,805	1,436	2,262	350	10,153	8,306	
July 31, 1891.....	57,782	52	1,400	3,983	1,336	1,656	700	9,075	8,618	
June 30, 1891.....	57,325	55 5	1,400	2,515	3,358	3,253	500	11,026	11,959	
May 31, 1891.....	58,258	55 5	1,250	2,646	2,021	3,805	400	10,122	11,180	
April 30, 1891.....	59,435	51 12 6	1,750	3,347	2,208	1,722	800	10,327	11,284	
March 31, 1891.....	60,253	53 2 6	1,800	3,685	1,737	1,112	400	8,734	9,982	
Feb. 28, 1891.....	61,481	52 15	1,650	2,506	1,368	2,731	500	8,755	8,670	
Jan. 31, 1891.....	61,396	52 12 6	1,350	3,333	1,873	1,438	300	8,294	12,264	
Dec. 31, 1890.....	65,366	52 10	1,750	2,252	3,049	4,406	350	11,807	11,881	
			20,650	35,051	23,173	31,078	6,200	116,152	123,872	
Nov. 30, 1890.....	65,440	55 7 6	2,050	754	1,247	3,544	850	8,445	11,230	
Oct. 31, 1890.....	68,225	58 7 6	2,400	754	1,393	3,628	350	8,525	10,206	
Sept. 30, 1890.....	69,906	59 10	2,700	1,075	1,649	4,063	700	10,187	10,240	
Aug. 31, 1890.....	69,950	60 5	2,500	1,345	2,643	2,355	550	9,393	11,967	
July 31, 1890.....	72,535	60	2,400	2,317	3,100	3,153	500	11,470	11,430	
June 30, 1890.....	72,435	58 10	1,300	2,529	1,949	2,855	600	9,233	18,781	
May 31, 1890.....	62,041	54 10	2,000	3,329	1,788	1,228	400	8,241	17,030	
April 30, 1890.....	90,230	49 2 6	2,400	1,316	1,463	2,663	500	8,342	10,050	
March 31, 1890.....	91,938	47 12 6	1,300	2,091	1,055	3,575	300	8,321	11,535	
Feb. 28, 1890.....	95,152	47	2,300	1,497	2,884	1,915	500	9,096	9,658	
Jan. 31, 1890.....	95,714	48 17 6	2,650	2,491	1,417	1,342	600	8,500	11,633	
Dec. 31, 1889.....	98,847	50 2 6	2,500	2,321	2,061	2,829	600	10,311	11,448	
			26,500	21,819	22,647	33,148	6,550	110,664	145,208	
Nov. 30 1889.....	99,984	50 2 6	2,700	3,060	1,610	1,389	600	9,859	13,415	
Oct. 31, 1889.....	103,540	44 2 6	1,350	3,232	4,386	2,133	600	11,761	13,890	
Sept. 30, 1889.....	105,689	43	1,650	3,199	1,526	2,145	600	9,120	9,436	
Aug. 31, 1889.....	105,985	43 10	1,950	3,575	2,154	3,703	350	11,792	13,923	
July 31, 1889.....	108,116	42	1,700	3,774	2,158	1,884	500	9,716	13,280	
June 30, 1889.....	111,689	41 10	700	500	1,377	1,481	700	4,758	10,489	
May 31, 1889.....	117,420	41	1,000	1,239	2,278	1,720	600	6,837	13,864	
April 30, 1889.....	124,447	37 15	2,100	1,712	815	2,303	650	8,089	8,509	
March 31, 1889.....	124,876	39 5	3,800	2,662	1,592	2,433	650	11,135	4,399	
Feb. 28, 1889.....	118,140	78	2,100	3,372	1,217	2,720	600	10,009	1,397	
Jan. 31, 1889.....	109,528	77 10	1,850	2,778	1,209	3,079	800	9,716	4,293	
Dec 31, 1888.....	104,105	77 10	2,900	2,588	2,164	2,738	1,000	11,390	5,191	
			23,800	31,751	22,484	28,488	7,650	114,173	112,095	

THE COPPER MINES OF CHILI.

(From our Special Correspondent.)

If the price of Chili bars falls to £35 to £40, as is the present outlook, some of the producers of this country will be obliged to close down. It will tell heavily upon Chili, as exchange will run eventually to about 30 pence; at present it is 22½ pence, but this is owing the curtailment of the production of nitrate and the fact of there being no more wheat to ship this year; also the increased wants of Chili and the heavy Government expenses. Our exports of copper for the first 10 months of this year were only 368,000 g. against 494,000 g. last year. The falling off was caused in part by the civil war, many mines having been allowed to fill with water. At present, Gossales Tragi, perhaps, the only one that is doing well, making about 12,000 g. of regulus per month. Panacilli has been making shipments to England, but at a loss, it is said, and if present prices continue, will probably shut down. The Copiapo Mining Company can continue, however, as it has an abundant supply of 20% ore. The Chafaral Company is not doing well; it has not paid a dividend for six years and is heavily in debt. It did well for the first six months of this year but has been losing since. Altogether the outlook for copper mining in Chili is bright.

COPPER PRODUCT OF VENEZUELA.

The following table gives the copper output of the Quebrada Railway, Land and Copper Company, Limited, for the past four years. This company is the only producer of consequence in Venezuela, and its statistics practically represent the total production of copper in that country:

MINERAL AND REGULUS SENT TO SWANSEA, FROM 1878 TO 1891, BY THE QUEBRADA RAILWAY LAND AND COPPER COMPANY, LIMITED.

Year.	Mineral sent to Tucacas.		Mineral sent to the furnaces.		Regulus sent to Tucacas.	
	Tons.	Per cent.	Tons.	Per cent.	Tons.	Per cent.
1878.....	8,293	15.36				
1879.....	12,908	14.82				
1880.....	16,121	13.50	4,771	9.28	221	23.25
1881.....	18,264	12.45	10,071	8.75	2,082	22.77
1882.....	28,716	10.82	18,597	5.78	3,303	21.79
1883.....	30,258	10.12	25,088	4.75	4,510	21.66
1884.....	30,994	11.16	22,364	5.62	5,055	20.25
1885.....	35,135	11.35	9,911	6.70	2,342	26.83
1886.....	28,629	11.56	3,249	6.84	1,345	31.29
1887.....	19,316	11.05	15,090	7.05	3,030	33.28
1888.....	26,008	11.09	27,065	6.98	5,001	32.47
1889.....	30,045	11.50	39,264	6.68	5,428	40.37
1890.....	17,950	11.37	55,751	8.10	8,788	40.83
1891*.....	19,936	11.30	66,592	8.30	8,960	33.25
Do.....	6,645		17,399		2,988	
	329,218		315,212		53,053	

*January to September, inclusive; October, November and December, approximately.

CORUNDUM.

By Prof. J. F. Kemp, School of Mines, Columbia College, New York.

Physical Characteristics.—Corundum is crystallized oxide of aluminum, Al₂O₃, and has a hardness expressed by 9, the hardest of known substances, the diamond, being represented by 10. It is usually found in rude crystals and irregular masses imbedded in micaceous minerals. The crystals have a tapering outline, and are a rough representation of a finger or a barrel in shape. They may be easily broken across their length parallel with the principal cleavage plane. The common test of corundum is its hardness. The crystals readily scratch quartz, and are harder than topaz. If the mineral is powdered, moistened with cobalt nitrate and heated before the blowpipe it assumes a blue color characteristic of alumina. Corundum is almost always associated with the micaceous minerals known as corundophyllite and margarite. The former is of green and the latter of pink color. Pure, crystallized corundum of blue color, is the gem sapphire, and when red is the ruby. When corundum is intimately mixed with magnetite or hematite it assumes a black granular appearance, and becomes the variety emery.

Corundum is the hardest of the minerals which are abundant enough to be extensively employed as an abrasive material, and for this purpose it is extremely valuable. It has also been utilized as a source of aluminum in the electric smelting processes. Emery has less hardness and is worth but about half as much as pure corundum. Garnet and other minerals of considerable hardness some times reduce the grade of the emery still further and are guarded against in purchasing. The usual test of quality is to compare a weighed sample with an equal amount of the standard grade, or of some well recognized brand; two weighed pieces of plate glass of convenient size are then rubbed together with the sample between, and the process continued until the grit has disappeared and until the plates no longer lose in weight from the abrasion. The amount of loss is a measure of the hardness and abrading power of the sample, the better grade giving, of course, the greater loss.

Occurrence.—Corundum has been found in a large number of localities in the United States, as a mineral, but only three places have been actual producers. The vein or bed at Chester, Mass., was recognized as emery, in 1863, by C. T. Jackson, while examining it as a deposit of iron ore. It has since furnished a large quantity of the mineral and the works established in connection with it have been the parents of others in the South. The corundum is found along the contact of gneiss and mica schist, and is associated with talc, chlorite and the micaceous minerals which almost always accompany it and which led Jackson to recognize it. Corundum has also been discovered in the serpentine rocks of South-eastern Pennsylvania in Chester County, and the deposits have attracted some attention. But the chief American source at present is a belt of serpentine that extends from southwestern North Carolina into Georgia. It is an altered olivine rock and has gneiss for its immediate associate, and along the contact of the two are found the veins (or beds) of decomposed rock which have the corundum disseminated through them. It is obtained by mining and is now prepared for market on the spot. Corundum Hill, in North Carolina, and Laurel Creek, in Georgia, are the chief producers—but it is not unlikely that others may be discovered. The corundum is crushed, sifted and washed, and thus comes to market in various sizes. Care is taken to avoid making undue amounts of the finest product, or flour—for this has less value than the coarser grades.

Production.—The production of corundum in the United States, from 1880 to 1889, both years inclusive, is given in the following table:

Year.	Short Tons.	Value.	Year.	Short Tons.	Value.
1880.....	1,014	\$29,230	1885.....	619	\$108,000
1881.....	500	80,000	1886.....	645	116,190
1882.....	500	80,000	1887.....	600	108,000
1883.....	550	100,000	1888.....	589	91,620
1884.....	600	108,000	1889.....	1,201	76,285

* Statistics collected by the Eleventh Census. Those for prior years include the product of North Carolina and Georgia only, and the values are given for mineral in a more advanced state of preparation; hence, they are of little value for comparison.

All the corundum consumed in the United States is of domestic production. The emery used comes principally from Asia Minor. The following table shows the imports of emery from 1886 to 1889, inclusive:

YEAR.	Grains.		Ore or Rock.		Other manufactures, value.	Total value.
	Quantity, lbs.	Value.	Quantity, tons.	Value.		
1886.....	527,244	\$31,862	3,782	\$88,925	\$851	\$121,638
1887.....	511,619	21,086	2,078	45,033	2,090	68,209
1888.....	430,397	16,216	5,175	93,287	8,743	118,246
1889.....	503,347	18,937	5,234	88,727	111,302	218,966

FELDSPAR.

By Prof. J. F. Kemp, School of Mines, Columbia College, New York.

Orthoclase, of a composition K₂O, Al₂O₃, 6SiO₂, is the principal feldspar mined. It occurs mingled with quartz and mica and much smaller amounts of certain rare minerals, and forms veins and feldspathic segregations in granites, syenites and crystalline schists. It is not certain whether these deposits are intruded igneous dikes, or deposited from solution like veins. Probably when they appear to fill fissures, like veins, they have been deposited by some hydrothermal action under great pressure and at a high temperature. The constitution of these veins is the same as that of a very coarse granite. The feldspar is often in such coarse masses that it can be hand picked. If crushed the minerals may be separated by washing. The mica of commerce comes from similar deposits. The localities which have, at one time and another, been productive are very numerous, but the low price of the article, \$5 per ton at Trenton, N. J., does not admit of expensive transportation. The other principal market is at East Liverpool, O., both being at the centers of the American porcelain manufacture. In Maine quarries have been operated at Edgcombe, Lincoln County, and Brunswick, Cumberland

County; in New York, at Tarrytown, Westchester County; Fort Ann, Washington County, and in the township of Crown Point, west of Port Henry, Essex County. In Connecticut the quarries are very extensive and are worked at South Glastonbury, Haddam and Middletown. They furnish a large proportion of the total product. In Pennsylvania there is an extensive opening at Brandywine Summit, Delaware County, and in Delaware are several smaller ones in New Castle County. Many other localities are known both in the East and in the West, but the question of transportation is too serious for their profitable operation. The annual production varies from 8,000 to 15,000 long tons, worth about \$5 per ton. The great use of the mineral is in the formation of a glaze for porcelain, and as an ingredient in the body of the ware.

GOLD AND SILVER.

The production of gold has increased slightly and has probably exceeded \$33,000,000. There have been no great discoveries of bonanzas during the year and the increased output has been due to the greater production of gold-bearing copper and lead ores. The hydraulic mines of California still remain closed by the mischievous State legislation which practically prohibits hydraulic mining. While there are no indications of any very rapid increase in the production of gold in this country, there is a certainty that the reduction in the costs of the treatment of gold ores by chlorination and other improved processes will insure for the future a steady increase in output, and there is always the possibility of a rapid temporary augmentation through the discovery of bonanzas. The gold production of the world is increasing and there are many indications of the advent of another gold boom like that of 1849-50 in California and of 1851 in Australia.

The great gold fields of South Africa have already added largely to the world's supply, though they are yet scarcely opened. The output of the Witwatersrand (South Africa) mines for the first eleven months of 1891 has been 648,908 oz., against only 494,801 oz. for the whole twelve months of 1890. There are reports of large gold bearing gravel deposits in other parts of South Africa, as well as in Brazil, which may at any moment start a new gold fever similar to those of old.

Silver has been produced in considerably larger quantity than in any previous year. This has been brought about by the higher price for the metal which ruled early in the year, and by the greater activity in the smelting of silver bearing lead and copper ores, due to the general prosperity of the country that called for a larger consumption of these metals.

The production of silver in the United States in 1891 is estimated at 59,000,000 oz., a portion of which, however, came from foreign, chiefly Mexican, ores, which, under the more liberal interpretation of the law continues to be imported notwithstanding the McKinley bill.

The purchase of no less than 4,500,000 ounces of silver a month by the United States Treasury was sufficient to absorb practically the entire production of American mines in 1891, but notwithstanding this the quantity of the metal offered has sent the price down to the point at which it started before the enactment of this law.

Many of the producers of silver believe the enactment of free coinage would benefit the market, and since they could then certainly disburse the

silver at its coinage value in payment of wages, they would gain the seignorage, for wages would not be increased.

The effect of the adoption of free coinage would, however, be to reduce the world's market price of silver as measured by gold, since it would remove from the market the only large purchaser who pays gold for it and it would, we believe, greatly retard the adoption by commercial nations of a common ratio at which either metal would be accepted.

This question will continue to be a disturbing element in the country until settled definitely by Congress, and as the aversion to free coinage, which all the great nations have abandoned and seem now more firmly opposed to than ever before, would involve great risks, it is to be hoped that prudence will rule in the counsels of the nation in deciding this important question.

While the production of silver in this country especially, and in the world generally, is increasing and will undoubtedly continue to increase at a rapid rate, it seems at present as though this would come rather from improvements in metallurgical processes and by the greater use of other silver bearing metals than from the opening of any "bonanzas." There has been none discovered in this country during the year and the great Australian bonanza of the Broken Hills has now passed its maximum output, the mine having already entered in depth the lower grade sulphide ores, and its output of both lead and silver will no doubt soon begin to decline.

The statement of the production of the Broken Hill Proprietary Company, Limited, in 1891 is interesting. It is as follows:

	1891.	Treated. Tons.	Yield. Silver lead.	Silver. Oz.	Oz. Per ton.
Twenty-six weeks to July 2.....	129,313		22,210	4,734,631	36½
Week ended July 9.....	4,810		673	177,970	37
" " " 16.....	4,953		743	178,308	36
" " " 23.....	5,300		742	180,200	34
" " " 30.....	4,504		676	180,160	40
" " " Aug. 6.....	4,683		563	178,334	38
" " " 13.....	4,201		630	180,643	43
" " " 20.....	4,043		687	177,892	44
" " " 27.....	4,551		546	177,489	39
" " " Sept. 3.....	4,500		495	180,000	40
" " " 10.....	4,097		574	180,263	44
" " " 17.....	4,511		632	171,418	40
" " " 24.....	4,233		635	169,320	40
" " " Oct. 1.....	4,936		543	177,696	36
" " " 8.....	4,446		578	177,840	40
" " " 15.....	5,298		795	238,410	45
" " " 22.....	4,195		545	180,385	43
" " " 29.....	4,217		506	177,114	42
" " " Nov. 5.....	4,309		517	180,978	42
" " " 12.....	4,393		615	180,113	41
" " " 19.....	4,290		588	176,400	42
" " " 26.....	4,422		531	176,880	40
" " " Dec. 3.....	4,760		714	176,120	37
" " " 10.....	4,900		735	178,400	40
" " " 17.....	4,849		824	178,413	37
Total for 50 weeks.....	243,570		37,840	9,242,078	38

During the year 1891 there was a very large export of gold from this country to Europe, due to financial stringency there, but the abundance of our crops and the scarcity of bread stuffs in Europe has brought most of the gold back to us. The "scare" caused by the rapid departure of our gold, while it lasted, was very serious, and it indicated, though faintly, what would happen were all our gold to disappear.

This matter also created great apprehension concerning the inadequacy of the entire stocks of gold and silver, and especially of gold, to meet the common requirements of the civilized world. Since, however, it is far easier to diminish the need of gold and silver by increasing facilities for balancing accounts between nations as between individuals, than it is to increase the output of these metals, the lesson should primarily stimulate the establishment of international clearing houses. Then, no doubt, the existing quantity of gold and silver would suffice for the needs of a vastly greater commerce than the world has ever seen.

With the market price of silver at 98.61 cts. per oz. troy, the ratio between gold and silver would be 21 silver to 1 gold, as against the United States coining ratio 16 to 1; but the world's production by weight is as 25 silver to 1 gold, which would make the value of silver about 82.3 cts. per oz. The present ratio of production in the United States is 36 silver to 1 gold. On this basis the value of silver would be about 57.4 cts. per oz.

At one time silver was at a premium as compared with gold, because it was not produced in sufficient quantity to supply the demand. Now, on the contrary, the output exceeds the demand, and the price has declined. Yet the free coinage advocates would reduce the demand by stopping moderate purchases by the Government, and would simply bring our silver coins down to the basis of bullion.

PRODUCTION OF GOLD AND SILVER IN THE UNITED STATES.

The following tables showing the production of gold and silver in the United States are taken from the annual reports of the Director of the Mint. The production for 1876 was estimated at \$78,700,000, of which \$39,900,000 was in gold, and \$38,800,000 in silver. The production for this year was not, however, distributed by states. The figures of the production of gold and silver in the United States from 1869 to 1875, inclusive, given in the table at the bottom of the preceding column were compiled by Dr. R. W. Raymond for the "Mineral Resources of the United States west of the Rocky Mountains." There was formerly so much guess work in collecting statistics of the

EXPORTS AND IMPORTS OF GOLD AND SILVER SINCE 1851.

YEAR.	Exports of gold and silver of domestic production since 1851.				Imports of gold and silver.			
	Gold.		Silver.		Gold.		Silver.	
	Bullion.	Coin.	Bullion.	Coin.	Bullion.*	Coin.	Bullion.	Coin.
1851.....		\$18,069,580						
1852.....		37,437,837						
1853.....		23,548,535						
1854.....		38,062,570						
1855.....	\$34,114,995	19,842,423						
1856.....	28,689,946	15,458,333						
1857.....	31,300,980	28,777,372						
1858.....	22,933,206	19,474,040						
1859.....	35,329,863	24,172,442						
1860.....	30,913,173	26,053,673						
1861.....	13,311,280	10,488,590						
1862.....	13,267,739	17,776,912						
1863.....	11,385,033	44,698,529						
1864.....	10,985,703	86,148,921	\$836,387	\$2,502,551				
1865.....	21,145,055	35,413,651	6,311,986	1,747,432				
1866.....	20,731,473	49,395,993	10,832,849	1,683,059				
1867.....	13,867,641	22,362,035	15,853,530	2,892,990				
1868.....	23,341,155	44,390,003	12,978,311	2,536,506	\$1,909,503	\$6,558,692	\$151,238	\$5,304,835
1869.....	13,584,407	14,838,369	13,573,427	899,763	890,064	13,240,191	54,267	5,622,548
1870.....	15,812,108	12,768,501	11,748,864	3,554,329	697,904	11,432,414	161,852	14,217,406
1871.....	9,069,959	55,491,719	17,285,916	2,535,765	1,177,387	5,704,298	69,836	11,591,875
1872.....	7,989,145	40,391,337	22,729,637	1,691,081	1,339,946	7,339,572	405,631	4,647,034
1873.....	8,810,175	35,661,863	27,759,066	1,674,442	1,557,670	7,092,011	476,698	12,318,911
1874.....	3,878,543	28,766,943	22,498,782	4,553,418	1,370,188	18,089,155	830,639	8,153,087
1875.....	2,233,775	59,309,770	17,197,914	5,115,670	1,577,989	12,018,537	1,294,763	5,913,474
1876.....	1,888,896	27,542,861	15,240,344	5,366,590	1,195,904	6,596,692	1,067,377	6,885,795
1877.....	1,084,536	21,274,565	11,482,894	9,292,743	2,118,855	24,131,925	4,663,605	9,829,696
1878.....	205,319	6,427,251	15,035,045	5,394,270	1,972,607	11,365,656	6,971,849	9,512,704
1879.....	24,774	4,120,311	11,883,054	1,526,886	1,293,698	4,373,168	2,424,675	12,203,871
1880.....	87,096	1,637,973	6,912,864	659,990	20,337,445	60,420,951	1,981,425	10,294,489
1881.....	84,943	1,741,354	11,852,395	547,642	30,998,919	69,632,304	2,303,472	8,240,766
1882.....	1,598,336	29,805,289	11,653,547	425,069	9,406,053	24,971,701	2,21,833	5,975,693
1883.....	4,118,455	4,802,454	12,551,378	159,834	3,334,708	14,309,441	2,475,908	8,279,274
1884.....	23,032,183	12,242,021	14,241,950	699,381	4,097,571	17,833,746	2,910,451	11,684,494
1885.....	395,750	2,345,809	20,422,924	1,211,627	3,849,237	17,842,459	4,530,384	12,020,243
1886.....	27,832,637	13,399,693	16,152,717	10,879,159	17,948,182	23,361,663	6,858,804	12,901,610
1887.....	1,085,889	8,051,650	19,672,171	7,941,437	19,538,669	25,364,658	9,601,108	11,399,613
1888.....	25,924,830	8,694,837	22,596,561	7,298,661	1,676,859	9,361,082	11,661,129	9,930,933
1889.....	40,545,934	10,402,339	27,220,000	13,509,015	1,736,800	13,038,249	12,175,620	13,765,728
1890.....	16,280,224	4,374,736	15,993,918	104,271	2,450,165	17,773,370	8,104,104	14,271,647
1891 (11 months).....	4,464,088	7,367,992	11,582,530	13,275,324	8,288,217	30,623,042	4,833,967	11,278,129

* From 1851 to 1885 the figures are for fiscal years ending June 30th; from 1885 to 1890, calendar years; for 1891, first 10 months.

mineral industry that the production figures for even gold and silver have been changed and generally reduced several times since they were first published. The first table gives the latest estimates of the Director of the Mint.

The production of gold received its first impulse in 1849 by the discovery of gold in California, and when in 1859-60 the output from this source had already commenced to decline, the discovery of the Comstock, which at first produced gold rather than silver, again increased the gold output of the country to \$53,000,000 in a year. Since then the gold production declined until by the stoppage of hydraulic mining in California by legislation the output declined to \$30,000,000 in 1883. The increase in the quantity of gold obtained from the treatment of ores for other metals and improvements in the extraction of gold from its ores are now adding yearly in a satisfactory and continuous manner to our gold production.

Silver production has steadily increased, even the decline in the Comstock has not been sufficient to arrest the growing figures. In recent

years the rate of increase has become more rapid, and promises to continue for nearly every condition which tends to increase the output of gold increases that of silver—the more abundant metal in the greater proportion. The present ratio of production is 1 of gold to nearly 36 silver by weight. It is easy to see how difficult it is to maintain a value ratio of 1 to 16 in the face of a production ratio of 1 to 36.

Table: PRODUCTION OF GOLD AND SILVER IN THE UNITED STATES FROM 1792. Columns: Years, Troy ounces, Gold, Silver, Total. Rows: 1792 to 1834, 1834 to 1844, 1845, 1846, 1847, 1848, 1849, 1850, 1851, 1852, 1853, 1854, 1855, 1856, 1857, 1858, 1859, 1860, 1861, 1862, 1863, 1864, 1865, 1866, 1867, 1868, 1869, 1870, 1871, 1872, 1873, 1874, 1875, 1876, 1877, 1878, 1879, 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890. Total: 1,872,016,269 Gold, 998,824,444 Silver, 2,870,895,713 Total.

Table: PRODUCTION OF GOLD AND SILVER IN THE UNITED STATES SINCE 1869. Columns: States and Territories, 1869, 1870, 1871, 1872, 1873, 1874, 1875. Rows: California, Colorado, Arizona, Idaho, Montana, Nevada, New Mexico, Utah, Washington, Other. Total: 61,500,000 Gold, 66,000,000 Silver, 66,663,000 Total.

Table: PRODUCTION OF GOLD AND SILVER IN THE UNITED STATES SINCE 1877. Columns: States and Territories, 1877, 1878. Rows: California, Colorado, Arizona, Dakota, Georgia, Idaho, Michigan, Montana, Nevada, New Mexico, N. Carolina, Oregon, Utah, Washington, Other. Total: \$45,100,000 Gold, \$38,950,000 Silver, \$84,050,000 Total.

Table: PRODUCTION OF GOLD AND SILVER IN THE UNITED STATES FROM 1879 TO 1880. Columns: States and Territories, 1879, 1880. Rows: Alaska, Arizona, California, Colorado, Dakota, Georgia, Idaho, Michigan, Montana, Nevada, New Mexico, North Carolina, Oregon, S. Carolina, Utah, Virginia, Washington, Other. Total: \$38,900,000 Gold, \$40,812,000 Silver, \$79,712,000 Total.

The distribution and totals for 1839 to 1875 (inclusive) are taken from the eighth annual report of mineral resources west of the Rocky Mountains by Dr. R. W. Raymond, 1876. The production for 1876 was not distributed by States, but was estimated at \$78,700,000 being \$39,900,000 in gold and \$38,800,000 in silver. The figures for the years 1877 to 1879 (inclusive) are taken from the reports of the Director of the Mint.

Table: PRODUCTION OF GOLD AND SILVER IN THE UNITED STATES FROM 1881 TO 1882. Columns: States, 1881, 1882. Rows: Alaska, Arizona, California, Colorado, Dakota, Georgia, Idaho, Montana, Nevada, New Mexico, N. Carolina, Oregon, S. Carolina, Utah, Virginia, Washington, Other. Total: \$4,700,000 Gold, \$43,000,000 Silver, \$47,700,000 Total.

Table: PRODUCTION OF GOLD AND SILVER IN THE UNITED STATES FROM 1883 TO 1884. Columns: States, 1883, 1884. Rows: Alaska, Arizona, California, Colorado, Dakota, Georgia, Idaho, Montana, Nevada, New Mexico, North Carolina, Oregon, South Carolina, Utah, Virginia, Washington, Other. Total: \$30,000,000 Gold, \$46,200,000 Silver, \$76,200,000 Total.

Table: PRODUCTION OF GOLD AND SILVER IN THE UNITED STATES FROM 1885 TO 1886. Columns: States, 1885, 1886. Rows: Alaska, Arizona, California, Colorado, Dakota, Georgia, Idaho, Montana, Nevada, New Mexico, North Carolina, Oregon, South Carolina, Utah, Washington, Other. Total: \$31,801,000 Gold, \$51,600,000 Silver, \$83,401,000 Total.

States.	1887.			1888.		
	Gold.	Silver.	Total.	Gold.	Silver.	Total.
Alaska.....	\$675,000	\$380	\$675,380	\$850,000	\$3,000	\$853,000
Arizona.....	830,000	3,800,000	4,630,000	871,500	3,000,000	3,871,500
California.....	13,440,000	1,500,000	14,900,000	12,750,000	1,400,000	14,150,000
Colorado.....	4,000,000	15,000,000	19,000,000	3,788,000	19,000,000	22,788,000
Dakota.....	2,400,000	540,000	2,940,000	2,600,000	100,000	2,700,000
Georgia.....	110,000	500	110,500	104,000	500	104,500
Idaho.....	1,900,000	3,000,000	4,900,000	2,400,000	3,000,000	5,400,000
Montana.....	5,230,000	15,500,000	20,730,000	4,200,000	17,000,000	21,200,000
Nevada.....	2,500,000	4,900,000	7,400,000	3,525,000	7,000,000	10,525,000
New Mexico.....	500,000	2,300,000	2,800,000	602,000	1,200,000	1,802,000
N. Carolina.....	225,000	5,000	230,000	136,000	3,500	139,500
Oregon.....	900,000	10,000	910,000	825,000	15,000	840,000
S. Carolina.....	50,000	300	50,300	200	200	400
Utah.....	220,000	7,000,000	7,220,000	290,000	7,000,000	7,290,000
Washington.....	150,000	100,000	250,000	145,000	100,000	245,000
Other.....	46,000	285,500	331,500	72,000	384,500	456,500
Total.....	\$33,136,000	\$53,941,800	\$87,077,800	\$33,167,500	\$59,206,700	\$92,374,200

States.	1889.			1890.		
	Gold.	Silver.	Total.	Gold.	Silver.	Total.
Alaska.....	\$900,000	\$10,343	\$910,343	\$762,500	\$9,697	\$772,197
Arizona.....	900,000	1,939,333	2,839,333	1,000,000	1,292,929	2,292,929
California.....	13,000,000	1,034,343	14,034,343	12,500,000	1,163,636	13,663,636
Colorado.....	3,500,000	20,085,333	24,185,333	4,150,000	24,307,070	28,457,070
Dakota.....	2,900,000	64,646	2,964,646	3,200,000	129,292	3,329,292
Georgia.....	107,000	465	107,465	100,000	517	100,517
Idaho.....	2,000,000	4,395,959	6,395,959	1,850,000	4,783,838	6,633,838
Montana.....	3,500,000	19,393,939	22,893,939	3,300,000	20,363,636	23,663,636
Nevada.....	3,000,000	6,206,060	9,206,060	2,800,000	5,753,535	8,553,535
New Mexico.....	1,000,000	1,461,010	2,461,010	850,000	1,680,808	2,530,808
N. Carolina.....	145,000	3,873	148,873	118,500	7,757	126,257
Oregon.....	1,200,000	38,787	1,238,787	1,100,000	96,969	1,196,969
S. Carolina.....	45,000	232	45,232	100,000	517	100,517
Utah.....	500,000	9,050,505	9,550,505	680,000	10,343,434	11,023,434
Washington.....	175,000	103,434	278,434	204,000	90,505	294,505
Other.....	95,000	378,368	473,368	130,000	461,574	591,574
Total.....	32,967,000	64,768,730	97,735,730	32,845,000	70,485,714	103,330,714

WORLD'S PRODUCTION OF GOLD AND SILVER FROM 1873 TO 1890.

Year.	Gold.	Silver.		Year.	Gold.	Silver.	
		Ounces (Troy).	Coining value.			Ounces (Troy).	Coining value.
1873.....	\$96,200,000	63,267,000	\$31,830,000	1882.....	\$102,000,000	86,470,000	\$111,800,000
1874.....	97,750,000	55,300,000	71,500,000	1883.....	95,400,000	89,177,000	115,300,000
1875.....	97,500,000	62,202,000	80,500,000	1884.....	101,700,000	81,597,000	105,300,000
1876.....	103,730,000	67,733,000	87,600,000	1885.....	108,400,000	91,632,000	118,500,000
1877.....	114,000,000	62,648,000	81,000,000	1886.....	106,000,000	93,276,000	120,600,000
1878.....	119,000,000	73,476,000	95,000,000	1887.....	105,775,000	96,141,000	124,304,000
1879.....	109,000,000	74,250,000	96,000,000	1888.....	110,244,000	108,888,000	140,734,000
1880.....	166,500,000	74,791,000	96,700,000	1889.....	122,438,500	123,500,000	159,678,000
1881.....	103,000,000	78,890,000	102,000,000	1890.....	116,009,000	128,914,000	163,677,000

THE WORLD'S PRODUCTION OF GOLD AND SILVER.

From Report of the Director of the Mint.

[Kilogram of gold, \$664.60. Kilogram of silver, \$41.56, at coining rate in the United States silver dollars. 1 kilog. = 32'1507 Troy ounces.]

COUNTRIES.	1887.				1888.				1889.				1890.			
	Gold.		Silver.		Gold.		Silver.		Gold.		Silver.		Gold.		Silver.	
	Kilos.	Dollars.	Kilos.	Dollars.	Kilos.	Dollars.	Kilos.	Dollars.	Kilos.	Dollars.	Kilos.	Dollars.	Kilos.	Dollars.	Kilos.	Dollars.
United States..	49,654	33,000,000	1,283,855	53,357,000	49,917	33,175,000	1,424,326	59,195,000	49,353	32,800,000	1,555,486	64,646,000	49,421	32,845,000	1,695,500	70,465,000
Australasia.....	41,119	27,327,600	6,422	266,900	42,974	28,560,600	120,308	5,000,000	49,784	33,086,700	144,369	6,000,000	45,767	30,416,500	312,033	12,968,000
Mexico.....	1,240	824,000	904,000	37,570,000	1,465	974,000	995,500	41,373,000	1,053	700,000	1,335,828	55,517,300	1,154	767,000	1,203,080	50,000,000
Russia.....	30,232	20,092,000	13,522	562,000	32,052	21,302,000	14,523	604,000	34,867	23,173,000	14,389	598,000	31,841	21,161,700	13,667	568,000
Germany.....	2,251	1,496,000	31,564	1,311,798	1,792	1,190,963	32,051	1,332,022	1,958	1,301,286	32,040	1,331,576	1,851	1,230,000	36,992	1,500,000
Austria-Hungary.....	1,877	1,247,450	53,391	2,218,900	1,820	1,209,572	52,128	2,166,440	2,198	1,461,000	52,651	2,188,000	2,104	1,398,500	50,613	2,103,500
Sweden.....	84	55,550	5,328	242,250	76	50,000	4,648	193,000	74	43,900	4,267	177,400	88	55,500	4,181	173,760
Norway.....	135	129,600	65,147	214,000	.....	.....	65,147	214,000	.....	.....	5,147	214,000	.....	.....	5,539	230,200
Italy.....	.....	.....	33,839	1,406,350	148	98,000	35	1,451	c148	98,000	c35	1,451	c148	38,000	c35	1,451
Spain.....	.....	.....	58,711	2,440,000	.....	.....	51,502	2,140,400	.....	.....	c51,502	2,140,400	.....	.....	c51,502	2,140,400
Turkey.....	10	7,000	1,323	55,000	10	7,000	1,323	55,000	d10	7,000	d13,233	55,000	d10	7,000	d1,323	55,000
France.....	.....	.....	54,314	2,257,300	.....	.....	49,386	2,073,000	400	266,000	80,942	3,363,950	b400	266,000	b80,942	3,363,950
Great Britain..	2	1,000	9,964	414,100	220	146,000	9,047	375,000	97	64,370	9,522	395,734	50	35,000	6,794	282,375
Dominion of Canada..	1,773	1,178,637	10,868	451,680	1,673	1,111,959	9,264	385,000	2,250	1,495,000	11,925	495,600	b2,250	1,495,000	b11,925	495,600
Argentine Republic..	45	30,000	722	30,000	47	31,000	10,226	425,000	e123	82,000	e14,681	610,150	123	82,000	14,681	610,150
Colombia.....	4,514	3,000,000	24,061	1,000,000	4,514	3,000,000	24,061	1,000,000	5,161	3,430,000	14,725	612,000	5,560	3,695,000	17,685	735,000
Bolivia.....	143	95,000	137,468	5,713,170	90	63,600	230,460	9,378,000	c90	59,800	c230,460	9,378,000	c90	59,800	c230,460	9,378,000
Chile.....	2,379	1,381,406	199,516	8,291,920	2,833	1,932,430	183,851	7,723,957	2,162	1,436,600	123,695	5,140,764	b2,162	1,436,600	b123,695	5,140,764
Brazil.....	884	654,000	.....	.....	670	445,300	.....	.....	670	445,300	.....	.....	670	445,300	.....	.....
Venezuela.....	2,960	1,967,216	.....	.....	2,130	1,415,598	.....	.....	2,765	1,838,000	.....	.....	1,742	1,158,000	.....	.....
Guiana (British)..	370	245,902	.....	.....	450	299,070	.....	.....	882	586,177	.....	.....	1,693	1,125,000	.....	.....
Guiana (Dutch)..	712	473,000	.....	.....	487	324,000	.....	.....	487	324,000	.....	.....	814	541,000	.....	.....
Peru.....	158	105,000	75,263	3,128,000	158	105,000	75,263	3,128,000	140	93,044	68,575	2,850,000	104	69,000	65,791	2,734,300
Central American States..	226	g150,000	48,123	g2,000,000	226	g150,000	48,123	g2,000,000	226	g150,000	48,123	g2,000,000	g226	150,000	g48,123	2,000,000
Japan.....	561	375,000	32,065	1,332,650	b606	403,000	h42,424	1,763,140	b606	403,000	h42,424	1,763,140	1382	254,000	136,855	1,531,700
Africa.....	2,888	1,919,600	432	17,960	6,771	4,500,000	.....	.....	12,920	8,586,632	.....	.....	14,877	9,887,000	.....	.....
China.....	k14,294	9,504,000	.....	.....	h13,542	9,000,000	.....	.....	13,542	c9,000,000	.....	.....	18,020	5,330,000	.....	.....
India (British)..	481	320,000	.....	.....	1,018	676,563	.....	.....	2,261	1,502,660	.....	.....	3,009	2,000,000	.....	.....
Total.....	159,155	105,774,955	2,990,398	124,280,978	165,809	110,196,915	3,385,606	140,706,413	184,227	122,438,469	3,842,109	159,678,168	174,556	116,008,900	4,010,516	166,677,233

a Estimate of the Bureau of the Mint.

b Estimated the same as officially communicated for 1889.

c Estimated the same as officially communicated for 1888.

d Estimated the same as officially communicated for 1886.

e Estimated the same as officially communicated for 1880.

f "Jaarcijfers over 1888 en vorige jaaren," No. 8, page 115.

CENSUS STATISTICS OF THE PRODUCTION OF GOLD AND SILVER IN THE UNITED STATES IN 1889.

The following table shows the production of gold and silver in 1889, as compiled by Mr. R. P. Rothwell, Special Agent of the Eleventh Census. They are more in detail and more accurate than the mint figures for the same year, but the difference between the two is not great.

STATES.	GOLD.		SILVER.		Gold and Silver Total.
	Fine Ounces.	Value.	Fine Ounces.	Value.	
Alabama.....	123	\$2,529	77	\$100	\$2,629
Alaska.....	43,762	904,650	9,218	11,918	916,568
Arizona.....	44,029	910,174	1,812,960		

PRODUCTION OF GOLD IN NEW SOUTH WALES FROM 1851.

Table with 6 columns: Year, Ounces, Value, Year, Ounces, Value. Data spans from 1851 to 1871.

PRODUCTION OF GOLD IN NEW ZEALAND FROM 1857.

Table with 6 columns: Year, Ounces, Value, Year, Ounces, Value. Data spans from 1857 to 1874.

THE GOLD MINES OF SOUTH AFRICA.

Although valuable auriferous veins were discovered in the Witwatersrandt district of the Transvaal early in 1883, it was not until 1886 that the gold mining industry began to assume the important dimensions which it has since attained.

MONTHLY PRODUCTION OF GOLD BY THE WITWATERSRANDT (SOUTH AFRICA) MINES FROM 1888 TO 1891 INCLUSIVE.

Table with 5 columns: Month, 1888 Ozs., 1889 Ozs., 1890 Ozs., 1891 Ozs. Lists monthly production from January to December.

The value of the Witwatersrandt gold is estimated by the Johannesburg Chamber of Commerce at 70s., or about \$17.50 per ounce.

The average number of stamps dropping in the district in 1890 was 1,046. The total amount of ore crushed in 1890 was 702,827 tons, the average yield of gold being 0.70 oz. per ton.

DIVIDENDS PAID BY WITWATERSRANDT (SOUTH AFRICA) MINES FROM 1889.

Table with 6 columns: Company, Amount, Per cent., Amount, Per cent., Amount, Per cent. Lists dividends for various mining companies from 1889 to 1891.

The amount of gold produced in other districts of South Africa is small in comparison with that of the Witwatersrandt, and statistics concern-

ing it are incomplete. In 1889, the output of the De Kaap district was 33,179 oz.; Lydenburg, 13,000 oz.; Klerksdorp, 6,600 oz.; Potchefstroom, 6,500 oz.; and the British Gold Coast, 28,500 oz.

THE PRODUCTION OF GOLD IN INDIA.

Most of the gold produced in India comes from the Colar field of Mysore, a small amount only being derived from the Madras Presidency. The production of the former from June, 1884, to January 1st, 1890, was £585,365.

Table with 4 columns: State, 1888, 1889, 1890. Lists gold production for Mysore and Madras.

* Estimated.

Nearly the entire amount of gold from Mysore is produced by four companies, viz.: Mysore, Ooregum, Nundyroog and Balaghat-Mysore.

RATIO OF SILVER TO GOLD EACH YEAR SINCE 1687.

(NOTE.—From 1687 to 1832 the ratios are taken from Dr. A. Soetbeer; from 1833 to 1878 from Pixley and Abell's tables, and from 1878 to 1891 from daily cablegrams from London to the Bureau of the Mint.)

Large table with 12 columns: Year, Ratio, Year, Ratio, Year, Ratio, Year, Ratio, Year, Ratio, Year, Ratio. Shows the ratio of silver to gold from 1687 to 1891.

PRICE OF BAR SILVER IN LONDON PER OUNCE BRITISH STANDARD, 925 FINE, AND THE EQUIVALENT PER OUNCE, 1,000 FINE, IN UNITED STATES GOLD COIN.

Table with 10 columns: Calendar year, Low est quotation, High est quotation, Average quotation, Value of a fine ounce at average quotation, Calendar year, Low est quotation, High est quotation, Average quotation, Value of a fine ounce at average quotation. Shows silver prices from 1833 to 1891.

PRICES OF SILVER AT NEW YORK AND LONDON IN 1891.

Month.	London.	New York.	Month.	London.	New York.
Jan. High	48 3/4	104 3/4	July High	46 3/4	101 3/4
Low	46 3/4	102	Low	45 3/4	99
Feb. High	46 3/4	102 3/4	Aug. High	45 3/4	100 3/4
Low	44 3/4	96 3/4	Low	45 15-16	98
March High	45 5-16	99 3/4	Sept. High	45 3-16	97 3/4
Low	44 3/4	97 3/4	Low	44 3-16	96 3/4
April High	45	98 3/4	Oct. High	45 1/4	98
Low	43 3/4	96	Low	44 1-16	95
May High	45 3/4	99 1/4	Nov. High	44 3/4	95 3/4
Low	44 3/4	96 3/4	Low	43 3/4	94 3/4
June High	46	101 3/4	Dec. High	44 3/4	95 3/4
Low	44 3/4	96 3/4	Low	43 3/4	94 3/4

COINAGES OF NATIONS.

[From the Report of the Director of the Mint.]

Countries.	1888.		1889.		1890.	
	Gold.	Silver.	Gold.	Silver.	Gold.	Silver.
United States...	\$31,380,808	\$33,025,606	\$21,413,931	\$35,496,683	\$20,467,182	\$37,202,908
Mexico.....	300,480	26,658,964	319,907	25,294,726	224,859	24,081,192
Great Britain...	9,893,375	3,681,886	36,502,536	10,827,602	37,375,479	8,332,232
Australasia.....	24,415,230	29,325,529	110,328	37,937,814	25,702,600	57,931,323
India.....	108,216	36,297,132	247,174	16,585	3,976,340	38,000
Canada.....	106,949	1,112,379	3,373,215	1,302,581	60,208	263,329
France.....	1,105,518	1,105,518	1,302,581	1,302,581	217,125	482,500
Cochin China.....	469,755	4,436,804	3,378,631	4,716,029	9,049,569	1,479,152
Italy.....	16,984	1,533,600	96,120	680,400	407,160	540,000
Switzerland.....	102,600	143,051	823,943	132,660	177,079	198,990
Spain.....	34,340,722	989,127	48,106,245	177,079	23,835,512	38,800
Portugal.....	2,747,633	5,516,190	3,294,987	4,528,259	2,818,750	3,857,118
Netherlands.....	53,600	53,600	53,600	53,600	120,600	120,600
Germany.....	16,714	1,080,040	142,253	833,432	258,867	258,867
Austria.....	62,483	62,483	27,607	57,931	44,840	44,840
Hungary.....	20,400,491	1,163,126	18,855,097	1,153,651	21,726,239	1,614,422
Norway.....	66,000	74,448	74,448	74,448	44,840	44,840
Sweden.....	257,154	8,483	8,483	8,483	1,416,626	1,416,626
Denmark.....	974,335	10,222,108	1,775,010	9,516,359	1,194,050	7,966,645
Russia.....	42,170	122,375	122,375	122,375	300,000	300,000
Turkey.....	8,316,325	8,316,325	8,316,325	8,316,325	2,842,531	2,842,531
Egypt.....	3,258,000	690,443	690,443	690,443	216,136	216,136
Siam.....	660,500	272,000	272,000	272,000	272,000	272,000
Japan.....	26,082	883,555	883,555	883,555	473,177	473,177
Hayti.....	1,763,452	1,763,452	1,763,452	1,763,452	258,010	258,010
Chili.....	244,000	244,000	244,000	244,000	300,000	300,000
Argentina.....	1,105,000	1,105,000	1,105,000	1,105,000	430,000	430,000
Peru.....	1,978	1,978	1,978	1,978	6,436	6,436
Columbia.....	567,814	567,814	567,814	567,814	28,951	28,951
Venezuela.....	28,951	28,951	28,951	28,951	28,951	28,951
Brazil.....	\$134,828,855	\$134,922,344	\$168,901,519	\$138,444,595	\$149,009,772	\$149,405,099
Ecuador.....						
Bolivia.....						
Costa Rica.....						
Straits Settlements.....						
Hong Kong.....						
Great Comoro.....						
French Colonies.....						
Eritrea.....						
British Africa.....						

* Rupee calculated at coining rate, \$0.4737. † Fiscal year. ‡ Silver florin calculated at coining rate, \$0.482. § Silver rouble calculated at coining rate, \$0.7718.

The Cape Copper Company.—The last annual report of the directors of the Cape Copper Company (Limited), recently issued, states that the profit and loss account shows that the value of the ore and metal returned for the past year was £231,641 19s. The average assay of the ore was 21 1/2%. The profit and loss account, including the amount brought from the previous year, shows a balance of £112,113 18s. 4d. This amount has been dealt with as follows: £1,416 8s. 10d. has been paid in income tax, and £75,000 in dividends; £10,000 has been transferred to a reserve fund, and £5,000 to a smelting and sulphate works sinking fund. The balance of £20,697 14s. 6d. has been carried forward. Owing to the considerable fall in the price of copper, and the discrepancies in the assays reported from the mines, the stocks brought over from the previous year's account show a further fall below the value therein attached to them. The past year's work was much affected by the circumstances arising out of the late operations of the French copper syndicate, but the directors now congratulate the shareholders upon the fact that the ill effect of the French combination is, as far as this country is concerned, at an end, and a dividend (possibly of about £4,000 or £5,000 may be expected from the liquidator of the *Société des Métaux*. The return of ore from Ookiep mine amounted during the 12 months to 22,974 tons of 2,000 lbs. The underground reserves are estimated at 88,000 tons of 2 1/2%, compared with 91,850 tons of 2 1/2% at the close of the previous year. The prospects at Spectakel mine have much improved, and an increased yield is anticipated. No material change has occurred in the Trial mines since the last report. The cost of these mines—which is a very heavy item—has, as hitherto, been debited to revenue account. The operations as regards smelting at Briton Ferry show an improvement over those of the previous year, especially during the latter portion of the past year. At the close of that period the work was showing still further improvement, and this has since been maintained. The operations of the current year are therefore producing better results. With reference to Tilt Cove establishment the earlier portion of the period under review was occupied in bringing the smelting and other surface operations into condition, and in properly opening out the work underground. The completion, up to a certain point, of the former is now giving important results, and the latter has enabled a considerable increase to be made in the quantity of ore extracted. A very satisfactory feature has been the fact that, as the workings have got deeper the assay of the ore shows improvement. The total cost per unit of copper during 15 months, including interest, commission and expenditure on Trial mines and Bodens' level, was 10s. 3d. per unit. During the period since the closing of the accounts this cost has been reduced to 8s. per unit.

GRAPHITE.

By Prof. J. F. Kemp, School of Mines, Columbia College, New York.

Graphite is a mineral of metallic luster, its color ranging from iron-black to dark steel-gray. Its hardness is 1.2 and its specific gravity from 2.25 to 2.27. It soils paper and has a greasy feel by which it is easily recognized, being distinguished from molybdenite by the streak, that of molybdenite having a slightly greenish cast. Molybdenite also affords a test for sulphur before the blowpipe.

Occurrence.—Graphite is a very common and abundant mineral in many regions of metamorphic rocks, and has attracted attention in various parts of the country. The only locality which has proved as yet an important producer, however, is Ticonderoga, N. Y., and its neighborhood. The old mines by which the place is best known are on a series of elliptical chimneys in gneiss which are filled with calcite and graphite. They were long since exhausted. The present source is a graphitic quartzite or schist in the town of Hague, N. Y., some five miles west of Lake George. There are crystalline limestones along Lake Champlain which also contain graphite, and might furnish the mineral. Any rock employed for this purpose must be free from mica, for it is impossible to separate two scaly minerals in the dressing.

A crude graphite, adapted for the manufacture of crucibles, stove blacking, etc., is found in conjunction with anthracite coal in Rhode Island. Graphite is also mined in Pennsylvania, Michigan, and Wyoming. Other deposits are known in this country, but none of them are worked. Most of the graphite used comes from Ceylon.

Preparation.—The rock consisting of about 10% graphite and the remainder quartz, which is worked at Lake George, is crushed in a battery of California stamps and then washed with buddles and settlers, the percentage of graphite being thus raised to 40 or 50%. This product is further treated at Ticonderoga by a secret washing process, whereby the grade is raised to 99%.

Production.—The quantity of graphite produced at Ticonderoga is not large, and could doubtless be considerably increased. The mines are owned by the Joseph Dixon Crucible Company and serve as a check on the price of Ceylon graphite which is principally used by that company. The production of graphite in the United States, together with the imports into the country, is shown in the following table:

PRODUCTION AND IMPORTS OF REFINED GRAPHITE.

YEAR.	Production.		Imports (d).			Total value
	Amount. Lbs.	Value.	Unmanufactured.		Manufactured.	
			Amount. Cwt.	Value.			Value.
1880.....	(a)	(a)	109,508	\$278,022	\$22,941	\$300,963
1881.....	400,000	\$30,000	150,927	381,966	31,674	413,640
1882.....	425,000	34,000	150,421	365,835	25,530	391,365
1883.....	575,000	46,000	154,833	361,949	21,721	383,670
1884.....	(b)	(b)	144,086	286,393	1,863	288,256
1885.....	327,883	26,251	110,462	267,228	.....	267,228
1886.....	415,525	33,242	83,368	164,111	.....	164,111
1887.....	416,000	34,000	168,841	331,621	.....	331,621
1888.....	400,000	33,000	184,013	353,960	.....	353,960
1889.....	(c) 400,000	(c) 35,000	177,381	378,057	.....	378,057
1890.....	.....	.....	255,948	594,746	.....	594,746

(a), (c) In 1880 the production of crude graphite amounted to 940 short tons, valued at \$49,800; in 1889, 7,003 tons, valued at \$72,662. (b) The production in 1884 was practically nothing. (d) From 1880 to 1888 the imports are for fiscal years ending June 30; subsequently, calendar years.

A considerable amount of graphite is used in its crude state for foundry facings, etc. Thus it will be observed from the preceding table that the production of refined graphite in 1889 was but 400,000 lbs., valued at \$33,000, while the output of crude graphite was 7,003 tons, valued at \$72,662.

Uses.—Graphite is largely used for pencils, and as a lubricant, for both of which purposes it must be soft and of high grade. Lower grades are used for crucibles, stove blacking, foundry facings, and as a substitute for red lead in pipe fitting. It is also being extensively employed as a paint for covering smoke stacks, boilers, tin roofs, etc., having been proved to be very durable. Recent experiments have shown that a graphitic lining for Bessemer converters is specially adapted to withstand the cutting action of acid slag, and a large demand for graphite has come from steel works in consequence, especially in Germany where this material has been adopted by the Krupp works. Thus, the imports of graphite into Germany, from Ceylon, are said to have increased from about 3,100 cwt. in the year ending June 1, 1889, to 14,215 cwt. in 1890, and 11,000 cwt. in 1891. The decrease in the last year was occasioned by the falling off of the output of Ceylon, from which island 148,000 cwt. of graphite were exported during the year ending June 1, 1891, against 162,000 cwt. in the twelve months preceding.

Price.—The price of graphite, or plumbago, as it is commonly called, varies according to its quality. It is divided into four grades, viz: Large lump, ordinary lump, chip, and dust. Large and ordinary lump are now worth from \$4.00 to \$5.00 per cwt.; chip, from \$3.50 to \$4.00; and dust from \$2.75 to \$3.50. The quality of plumbago depends as much upon its physical structure as upon its chemical composition.

GYPSUM.

By Prof. J. F. Kemp, School of Mines, Columbia College, New York.

As a useful mineral gypsum finds two principal applications. It is either ground fine and put on land as a fertilizer, or else it is calcined for plaster of paris and employed as a cement. The earthy and dark varieties serve as fertilizer in the crude state, while the purer and whiter material finds a better market after calcination in the many applications of plaster of paris. The pure mineral is the hydrated sulphate of calcium, CaSO₄ + H₂O, but alumina, oxides of iron and silica sometimes contaminate it. When in clear crystalline masses gypsum is called sele-

nite. It has a pearly luster and a cleavage almost equal to mica, so that it is readily split into very thin plates. It is softer than mica and is readily scratched with the thumb nail. These plates occur in all the quarries, but are in comparatively small amounts. The pure massive gypsum resembles finely crystalline marble, and indeed is often carved under the name of alabaster. It does not effervesce with acids, as does limestone, and is much softer. The earthy and impure gypsum is drab or black in color and closely resembles limestone, from which, however, the lack of effervescence distinguishes it. Small flakes and coatings of native sulphur are very common in deposits of gypsum.

In the kiln, the mineral loses its water of composition. The anhydrous sulphate remains and has the extreme affinity for water and the property of setting, which give it its value. In the United States, gypsum is produced in the largest quantity in the region about Grand Rapids in Michigan. It occurs in strata of Subcarboniferous age, and is found over some eight or ten square miles at a depth of 2 ft. to 70 ft. There is an upper bed 8ft. thick, followed by 1 ft. of soft slate, and then 12 ft. of the pure mineral. The last is the bed exploited. It is creamy white, rose and light gray in color, and furnishes grades for fertilizers (called land plaster), and for stucco. All the mines are controlled by a trust or combination, which assigns to each concern its share of the business. The headquarters of the trust are at Grand Rapids.

The second area in production is in New York along a belt extending eastward from the foot of Cayuga Lake. The gypsum is of an earthy-black color and is all ground for land plaster. The beds belong geologically to the Salina Group, for although they have been recently referred to the Lower Helderberg by Prof. S. G. Williams, he overlooked a roll or low fold at Union Springs, which occasioned some confusion in his stratigraphy. The gypsum is closely associated with black limestone and shale.

Iowa ranks third in total product. Fort Dodge is the headquarters of the industry and the quarries are situated along the Des Moines River in Webster County. The gypsum is of an age later than the Subcarboniferous, but it is thought by C. A. White to be older than the Cretaceous and probably early Mesozoic.

The plaster industry in Kansas is one of great and growing importance. The gypsum is principally produced in Marshall, Saline, Dickinson, Sedgwick and Barbour counties, which extend across the State in a slightly northeast line near the middle. All the product is calcined for plaster of paris. Kansas now ranks fourth in the total output.

The deposits in Southwest Virginia along the Holston River come fifth. The gypsum occurs in the same region with extensive beds of salt, and is thought by C. R. Boyd to lie along one or several great fault fissures in Carboniferous and Silurian strata. It is all employed as a fertilizer.

The gypsum district of Ohio centers about Sandusky, but the quarries are at the town of Gypsum, 10 miles west. The mineral is in strata of Lower Helderberg age. The bed worked is 7 ft. thick and lies about 24 ft. below the surface. The mineral is worked up into both stucco and land plaster, about 40% being applied to the former purpose and 60% to the latter. The rock is of excellent grade and purity, but this district is overshadowed by the output of the Grand Rapids region.

Utah has become in the last few years an important source of the mineral, it being found there in Juab, Beaver, San Pete and Iron counties. Considerable plaster of paris is also produced at Colorado City, near Colorado Springs, Colo.; and another region deserving mention is, Santa Barbara County, Cal. Small amounts come from South Dakota and Wyoming, and the relative importance is shown by the following table of production:

	Tons.*	Value.		Tons.*	Value.
California.....	3,000	\$30,000	New York.....	52,608	\$79,476
Colorado.....	7,700	28,940	Ohio.....	9,920	51,491
Iowa.....	21,784	55,250	Utah.....	16,000	25,000
Kansas.....	17,332	94,235	Virginia.....	6,838	20,336
Michigan.....	131,767	373,740	S. Dak. and Wyo.....	820	5,650

* Tons of 2,000 lbs.

Large quantities of gypsum are annually imported into the cities of the Atlantic seaboard from Nova Scotia. The mineral is derived from the Windsor and Cheverie districts on the Bay of Minas. Its geological age is Lower Carboniferous. The best of it is ground at New York City and Newburgh, N. Y., for terra alba, a cheap white pigment.

Discovery and Development of Hard Coal (anthracite) in the Palatinate is referred to in *Glückauf* of November 12th. It appears that the seams contain a very good quality of hard coal in sufficiently heavy seams to make the working profitable, with promise of rapid development and large yield. In the same number and paper is given a résumé of the development of coal mines in China and Japan, with the output of the different districts. The latter country especially shows rapid increase in production.

Formation of Graphite.—In a paper on the formation of graphite by contact metamorphism, by R. Beck and W. Luzi—*Journal of the Chemical Society*—the authors claim to have discovered some beautifully crystallized graphite in rocks which have been metamorphosed by contact with ancient volcanic rocks; the graphite crystals are easily discernible from the amorphous carbonaceous substances of the original clay slates and siliceous slates. The authors have proved that graphite has been formed from carbonaceous substances by contact metamorphism in the case of certain rocks in Saxony. In Pirna and Kreischa, upper Silurian clay slates and siliceous slates occur, which are very rich in carbonaceous substances, and lie partially within the region of contact of the granite and hornblende granite; those within this region of contact have become converted into graphitic rocks. A chialitolite slate and a graphitic quartzite were examined. The graphite had a greasy feeling, and produced a metallic streak; it had also a metallic luster. Analysis showed that the graphite from the chialitolite slates had the composition C = 98.84%, H = 0.21%; while that from the graphitic quartzite had the composition C = 99.94%, H = 0.05%. The graphitic quartzite itself contained over 2% of graphite, and its specific gravity was 2.62—2.637. Proof is therefore afforded by this discovery that graphite is formed in nature from amorphous carbon in much the same manner as it is produced artificially.

IRON AND STEEL.

The year 1891 was one of the most remarkable that the iron trade has ever experienced. Coming after two succeeding years of extraordinary activity, it began in the cloud of financial depression which overcast the whole world immediately after the collapse of Argentine securities in London and the failure of the great English firm of Baring Brothers. In the United States, while the general financial condition was apparently excellent, there were enough reasons to cause a feeling of insecurity, if not of despondency. Crops had been below an average. The troubles in Europe had caused an unloading of railroad bonds upon the American market, and a consequent depression of every railroad security. The McKinley tariff act had just gone into effect, and its prospective results upon business were a matter of doubt. The Congressional elections in November presaged the possibility of an early repeal of that act, and the effect of such a repeal was still more uncertain. Legislation in the direction of free silver coinage was threatened. Some, or all, of these causes led to general want of confidence in investors, the stopping of new enterprises, the delay of repairs and renewals, and the general "hand to mouth" character of buying supplies which always characterizes times of depression, and moreover tends to intensify and prolong it. The result upon the iron trade was immediate and extraordinary. The production of the blast furnaces, which had reached a maximum of over 180,000 gross tons per week in December, 1890, decreased to 114,000 tons in May, and the statistics issued by the American Iron and Steel Association in July showed that the production for the first six months of the year was only 3,776,556 net tons, as compared with 5,107,775 net tons in the corresponding six months of 1890, a decrease of 1,331,219 tons, or about 26%. Such a rapid decrease was entirely unprecedented.

Not the least extraordinary feature of the history of these first six months of 1891 was the firmness with which prices were held, notwithstanding the decrease in demand. In all previous depressions in the iron trade there has been a fall from a position of large demand, large production and high prices down to one of small demand, small production and low prices; but in the depression of 1891 prices had not such a pinnacle to fall from as in the former ones. They were low enough already; the selling price of iron being apparently regulated by the bare cost of production at those furnaces whose locations and equipment are not the best, and which can make profit only when prices are moderately high. A drop of 50 cents a ton in the price of pig iron forces many such furnaces out of blast, and a rise of a dollar a ton or a decrease in the price of ore starts them again. The slight drop in price took place in January, 1891, Bessemer iron at Pittsburg, as shown in our quotations elsewhere, falling from \$16.75 in December, to \$16.35 in January, and grey forge falling in the same time from \$14.75 to \$14.25. This drop had its effect, many furnaces went out of blast, and those that stayed in were strong enough to maintain prices, so that in March, with a greatly decreased demand and production, the price of Bessemer was \$16.50 and of grey forge, \$15. The strike in the coke regions no doubt had some effect in helping to maintain prices, but whatever the several causes, the result, a maintenance of prices in the face of an extraordinary decrease of demand, is altogether an exceptional occurrence. In the steel rail trade a similar firmness was manifested, rails being steadily quoted throughout the year at \$30 per ton, but this was evidently due to the pooling agreement between the companies, and to the consolidation of the rail manufacture into the hands of a few companies of great financial strength, who were willing to delay receiving of orders for a year if necessary rather than cut prices. Not less remarkable than the extraordinary depression was the rapidity of recovery from it. By May 1st it had reached its worst, and during May and June many idle furnaces were blown in, and production increased to about the average of that of last year. A further slight increase took place during the summer and fall, and by November 'st the maximum rate of production of over 180,000 gross tons reached in December, 1890, per week, had been reached and passed, and we close the year out with blast furnaces producing a greater quantity of iron than at any previous period in our history. Yet notwithstanding this increase of consumption and production prices have steadily declined toward the end of the year, and as shown in our quotations elsewhere, are in general lower than ever before in the history of the trade. The production of pig iron in the first six months of the year, according to the official statistics, was 3,776,556 net tons. We estimate that the production for the second half of the year will be just about the same as that of the second half of the year 1890, which was 5,199,253. The comparative figures of the two years will then stand as follows:

	1890.	1891.
1st half.....	5,107,775	3,776,556
2d half.....	5,199,253	5,199,25
Total.....	10,307,028	8,975,309

Or practically a total for 1891, in round numbers, of 9,000,000 net tons, showing a decrease, as compared with 1890, of 1,300,000 tons, or nearly 13%.

The production of steel rails, according to figures we have received from the Rail Makers' Association, is estimated at 1,090,000 tons, as compared with 2,095,996 tons in 1890, a decrease of over 1,000,000 tons, or nearly 50%. How much of this decrease was due to the necessity of the railroads to postpone purchasing, on account of stringency of their finances, and how much to their unwillingness to pay the pool price of \$30 per ton, may be left to conjecture.

As it takes at least 1.13 tons of pig iron on an average to produce a ton of steel rails, this decrease of 1,000,000 tons production of rails accounts for a decrease of 1,300,000 tons in the consumption of pig, an amount equal to the total decrease of pig iron production, and thus we are led to the conclusion that the consumption of iron for all purposes other than rails was as great in 1891 as in 1890, notwithstanding the extraordinary depression of the first six months of the year.

In our review of the iron trade one year ago (see *JOURNAL* of January 3d, 1891, page 3) we said: "There never was a time when the outlook into the immediate future of the iron trade was more uncertain than at present, and when it was more unsafe to make predictions." At this time, however, it requires no gift of prophecy to state that the production and consumption of pig iron will be greater in 1891 than in 1890, and we shall

not be surprised if the production of 1892 is over 25% more than that of 1891, making the total for 1892 of 11,250,000, or even 11,500,000 tons. As to prices, we do not feel the same confidence. The trade in general is looking for advanced prices, but as in the past five years great increase in demand has not caused an increase in price, we fear that those who expect high prices in 1892 will be disappointed. The constant tendency is to increase the productive capacity of our furnaces, and always to keep it ahead of any prospective demand. The reported figures of the productive capacity of the coke furnaces on December 31 of the past three years shows the following:

	Coke furnaces in blast.	Weekly production. Gross tons	Average daily product. Gross tons.
Dec. 1, 1889.....	162	116,000	102
" 1890.....	168	127,600	109
" 1891.....	162	142,700	126

As the coke furnaces of most recent construction, working on Lake ore are designed for a capacity of 300 tons per day, it is likely that the average product of all coke furnaces will tend to increase for a long time to come. On this point we cannot do better than to quote from our review of last year: "The experience of the past should have taught the trade that a

THE NEW YORK IRON MARKET IN 1891.

Low but steady prices have been the most prominent characteristic of the iron market throughout the year 1891. On January 1st the capacity of furnaces in blast was reported to be 165,000 gross tons of iron, as against 180,000 tons only one month before. From this date the production steadily fell off until it amounted to 115,500 gross tons weekly in May, the minimum of the year. A steady increase followed, and for the week ending November 30th the output in round numbers was 190,000 gross tons, the heaviest ever made. Early in the year the Baring failure and the attendant financial depression abroad, followed a little later by a stringency in the home money market, put a quietus upon the development of many projected industries and the stagnation became general. The iron trade, the barometer of all industries, was the first to reflect the condition, being thrown into a state of almost unparalleled dullness. The strike among the Southern blast furnaces, the demand of the furnace men of the Mahoning and Shenango valleys for a reduction in the price of raw material and freights, the lessening by about \$1 per ton of the cost of lake ore, and a slight concession in the price of coke, the Connellsville coke strike, the tightening of the money market, the heavy gold exports and the threatened legislation of the 51st Congress

STATISTICS OF PIG IRON, RAILS, ETC., FROM 1860 TO 1890, INCLUSIVE.

YEAR.	Miles of railroad built.	Iron rails made in United States. Net tons.	Steel rails made in United States. Net tons.	Total rails made in United States. Net tons.	Rails imported. Net tons.	Approximate rail consumption. Net tons.	Pig iron made in United States. Net tons.	Pig iron imported. Tons of 2,000 lbs.	Total steel ingots made in the United States (including crucible). Net tons.	Rolled iron, except rails made in the United States. Net tons.	Prices per ton of 2,240 pounds.			Pig iron produced in Great Britain. Tons of 2,000 pounds.	Importation. Number of persons.	Year.
											Pig iron.	Iron rails.	Steel rails.			
1860.....	1,846	205,038	None.	205,038	136,836	341,874	919,770	80,178	.....	.....	\$22 3/4	\$48	.....	4,285,962	.....	1860
1861.....	651	189,818	None.	189,818	83,429	273,247	731,544	82,909	.....	.....	20 1/4	42 3/4	.....	4,157,877	89,724	1861
1862.....	834	213,912	None.	213,912	9,644	223,556	737,623	24,921	.....	.....	23 3/4	41 3/4	.....	4,416,685	89,007	1862
1863.....	1,050	275,768	None.	275,768	19,139	294,907	947,604	34,720	.....	.....	30 1/4	70 3/4	.....	5,051,245	174,524	1863
1864.....	738	335,369	None.	335,369	132,960	468,329	1,135,996	114,490	.....	.....	53 3/4	126	.....	5,340,049	193,195	1864
1865.....	1,177	356,292	None.	356,292	86,820	443,112	931,582	56,730	.....	.....	46 3/4	98 3/4	.....	5,307,564	247,453	1865
1866.....	1,716	430,778	None.	430,778	87,368	518,146	1,350,343	114,679	.....	.....	46 3/4	86 3/4	.....	5,066,764	314,917	1866
1867.....	2,449	459,538	2,550	462,088	163,049	625,137	1,461,626	125,487	.....	.....	41 1/4	83 1/4	.....	5,332,346	310,965	1867
1868.....	2,979	499,489	7,225	506,714	250,081	756,795	1,603,000	125,590	.....	.....	39 1/4	78 3/4	.....	5,596,631	289,145	1868
1869.....	4,615	583,936	9,650	593,586	313,163	906,749	1,916,641	153,412	.....	.....	40 3/4	77 1/4	.....	6,099,248	385,237	1869
1870.....	6,070	586,000	34,000	620,000	399,153	1,019,153	1,865,000	171,677	.....	.....	37 1/4	72 1/4	.....	6,679,137	355,303	1870
1871.....	7,379	737,483	38,250	775,733	566,202	1,341,935	1,911,608	245,535	.....	.....	35 1/4	70 1/4	.....	7,422,440	346,938	1871
1872.....	5,878	906,930	94,070	1,000,000	530,850	1,530,850	2,854,558	296,967	.....	.....	48 3/4	85 1/4	.....	7,550,960	437,750	1872
1873.....	4,097	761,062	123,015	880,077	258,772	1,138,849	2,868,278	154,708	.....	.....	42 3/4	76 3/4	.....	7,354,425	422,545	1873
1874.....	2,117	584,469	144,944	729,413	108,311	837,724	2,689,413	61,165	.....	.....	30 1/4	58 3/4	.....	6,710,377	260,814	1874
1875.....	1,711	591,649	230,863	822,512	19,448	811,960	2,366,581	66,457	.....	.....	25 1/4	47 3/4	.....	7,129,317	191,231	1875
1876.....	2,712	487,168	412,461	899,629	287	879,916	2,063,236	83,072	.....	.....	22 1/4	41 3/4	.....	7,342,717	157,440	1876
1877.....	2,280	332,540	432,169	764,709	35	764,744	2,314,585	68,861	.....	.....	18 1/4	35 1/4	.....	7,401,704	130,502	1877
1878.....	2,679	322,890	550,398	873,288	10	882,695	2,577,361	74,484	.....	.....	17 3/4	33 3/4	.....	7,146,777	153,207	1878
1879.....	4,817	420,160	683,964	1,104,124	44,147	1,148,271	3,070,875	340,672	.....	.....	19 3/4	41 1/4	.....	6,714,787	250,565	1879
1880.....	6,712	493,762	954,460	1,448,222	290,689	1,738,911	4,295,414	784,968	.....	.....	28 1/4	49 1/4	.....	8,679,141	582,703	1880
1881.....	9,847	488,581	1,330,302	1,818,883	386,321	2,205,204	4,641,564	520,835	.....	.....	25 1/4	47 1/4	.....	9,382,648	72,045	1881
1882.....	11,569	227,874	1,438,155	1,665,929	224,127	1,912,921	5,178,122	604,978	.....	.....	25 3/4	45 1/4	.....	9,617,082	730,349	1882
1883.....	6,743	64,954	1,286,554	1,351,508	33,977	1,385,485	5,146,972	361,366	.....	.....	22 3/4	Not quoted	.....	9,552,816	570,316	1883
1884.....	3,924	25,560	1,119,291	1,144,851	3,168	1,148,019	4,589,613	206,381	.....	.....	19 1/4	.....	.....	8,749,134	461,346	1884
1885.....	2,390	14,815	1,079,400	1,094,215	2,452	1,096,667	4,529,869	164,349	.....	.....	18	.....	.....	8,305,325	332,361	1885
1886.....	8,100	23,679	1,768,922	1,792,601	46,578	1,839,179	6,365,328	406,180	.....	.....	18 3/4	.....	.....	8,850,924	392,387	1886
1887.....	12,872	23,062	2,373,335	2,396,397	154,369	2,550,766	7,187,206	523,625	.....	.....	21	.....	.....	8,466,660	516,933	1887
1888.....	6,801	14,252	1,557,892	1,572,144	70,602	1,642,746	7,203,507	220,905	.....	.....	18 3/4	.....	.....	8,958,845	525,019	1888
1889.....	5,135	10,258	1,694,610	1,704,868	6,360	1,711,830	8,516,079	166,610	.....	.....	17 3/4	.....	.....	9,234,776	431,945	1889
1890.....	6,344	15,548	2,065,996	2,111,544	228	2,111,772	10,307,028	151,150	.....	.....	18 3/4	.....	.....	8,820,145	495,021	1890

MONTHLY PRICES OF PIG IRON, STEEL RAILS, SPIEGELEISEN AND FERRO-MANGANESE AT NEW YORK IN 1891.

Per ton of 2,240 lbs.	MONTH												Average.	Var'tion.	
	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.			
Northern No. 1 Foundry.....	Highest \$18.00	\$18.00	\$18.00	\$18.00	\$18.00	\$18.00	18.00	\$18.00	\$18.00	\$18.00	\$18.00	\$18.00	\$18.00	18.00	.....
dry.....	Lowest 17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.00	17.00	17.00	17.00	17.00	17.00	17.25	.50
Northern No. 2 Foundry.....	Highest 17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	16.50	16.50	16.50	16.50	16.50	.....
dry.....	Lowest 16.50	16.50	16.50	16.50	16.50	16.50	16.50	16.00	16.00	16.00	16.00	16.00	16.00	16.83	.50
Southern No. 1 Foundry.....	Highest 17.50	17.50	18.00	18.00	18.00	18.00	18.00	17.50	17.50	17.50	17.50	17.50	17.50	17.71	.50
dry.....	Lowest 16.50	16.50	17.50	17.50	17.50	17.50	17.00	16.50	16.50	16.50	16.50	16.50	16.50	16.87	\$1.00
Southern No. 2 Foundry.....	Highest 16.50	16.50	17.00	17.00	17.00	17.00	17.00	16.50	16.50	16.50	16.50	16.50	16.50	16.71	.50
dry.....	Lowest 15.50	15.50	16.00	16.50	16.50	16.50	16.50	16.00	16.00	16.00	16.00	16.00	16.00	15.83	1.00
*Steel rails.....	Highest 30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	.....
dry.....	Lowest 28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.83	1.00
2% Spiegeleisen.....	Highest 29.00	29.00	29.00	29.00	29.00	29.00	29.00	28.50	28.50	28.50	28.50	28.50	28.50	28.475	1.50
dry.....	Lowest 28.00	28.00	28.00	28.00	28.00	28.00	28.00	27.50	27.50	27.50	27.50	27.50	27.50	27.83	1.50
80% Ferro-manganese.....	Highest 65.00	64.00	64.50	64.50	64.50	65.00	65.00	65.00	64.00	64.50	65.00	63.00	62.00	64.395	3.00
dry.....	Lowest 61.50	63.00	62.50	63.50	64.50	64.00	64.00	63.00	64.50	63.00	61.50	61.50	63.04	3.00	

*Price f. o. b. mill.

scarcity of either ore or iron never lasts a great while, that the productive capacity of the country is never less than the demand for over a few months at a time, and that a rise of prices caused by a fear of scarcity is sure to be followed by a sudden collapse. On the other hand, low prices may last a long time, continuing through periods of both advancing and declining production; through the latter on account of decrease of demand, through the former on account of steady increase of producing capacity and steady tendency to greater cheapness of production."

"Looking ahead, we see a constantly increasing consumption of iron, and a necessity for building, within two or three years at the most, more blast furnaces, and the price of iron will rise sooner or later to the normal average of the last six years. The price cannot rise greatly above this average, except during temporary 'scarcities' and 'booms,' lasting only a few months, so long as our practically inexhaustible supplies of ore and fuel continue. So long as the Lake Superior region can increase its production 40% in one year, as it did in 1889, and so long as the blast furnaces can be built fast enough and driven fast enough to increase their production 40% in two years, as they have done, there need be no fear of any scarcity of iron, and no real cause for any great rise in prices."

on the silver question, which prompted capitalists to withdraw money from investments, were all events of the first six months which complicated the situation of the trade. During the second half of the year conditions became more healthy, and the future promising. Congress adjourned, removing all possibility of immediate silver legislation. Gold exports were stopped, and gold imports began. The reports that European crops were almost a total failure, and that those of this country were unprecedentedly large, were confirmed. Later, as cereals began to move to markets, railroads showed increased earnings, the bond market became easier, and the financial policy of the administration was pronounced in favor of a gold monetary basis. The production of pig iron increased to the largest figures ever known, but prices remain as before, low, but steady. At the close of the year dealers complain, however, that the market is dull, spiritless and unresponsive, and that the vitality of the trade has been sapped by over production. To-day there prevails the hand-to-mouth buying similar to that of nine months ago. For the great demand has come, but production has more than kept pace with it, and the hope for advanced prices has not materialized.

Pig Iron.—The remarks on the general situation apply directly to the pig iron market. The year was ushered in on the following basis of prices:

Northern, No. 1 X, \$18.00 to \$17.50; No. 2 X, \$17.00 to \$16.50; Southern, No. 1 X, \$17.50 to \$16.50; No. 2 X, \$16.50 to \$15.50, and with the exception of an advance of 50c. a ton in Southern No. 1 X, ruled steadily throughout the year. From the start buying was only for immediate requirements. Prices have ruled firmly, not because of any healthy market conditions, but because they afforded but a minimum margin of profit.

After that midsummer dullness, common to all trades, and during which a slight reduction of prices was made in the poorer brands, there was a decided increase in the volume of consumption. This increase has continued up to the end of the year, but it has brought no advance in prices. The Thomas Iron Company has, as usual, figured very prominently in the trade, and during the last two months of the year has booked orders for a heavy tonnage over a portion of 1892, at the present ruling quotations, guaranteeing purchasers the benefit of any reduction in price which may rule at the time of delivery.

The position of Southern irons in the markets of the country is no longer problematical. During the year they have sold in New York in direct competition with Northern makes, the best brand of each on the same basis. However, they have been less steady than those of Northern manufactures owing to the weaker financial condition of some of the furnace companies.

Scotch Pig Iron.—During the year there has been a marked decrease in the use of Scotch pig. In 1890, 14,000 tons were imported, and it is estimated that not over 7,000 tons have been imported during 1891. The extremely low cost of the Ohio softeners, which it is claimed serve in every way as a substitute, has practically excluded the Scotch brands from the market.

Steel Rails.—The market for steel rails has been a waiting one, the suspense being relieved by purchases for absolute immediate requirements. The consumption has consisted largely of repairs; construction of new mileage has been light.

The year opened with standard sections quoted at \$27.50. Early in January the selling price was advanced to \$28. A little later the combination, composed of all the important rail mills, apportioned percentages as follows: Pennsylvania Steel Company, 9%; Lackawanna Coal and Iron Company, 18%; Bethlehem Iron Company, 8%; Cambria Iron Company, 8%; Carnegie Bros. & Co. and the Illinois Steel Company, 57%. The organization is to exist for three years, and the price is fixed at \$30 for standard sections f. o. b. mills. The lowest rate of freight from an inland mill to tidewater is 80c., and is from the Bethlehem Iron Company's plant at Bethlehem, Pa. This sum was added by the combination to the f. o. b. mill price, thus establishing the tidewater rate. The first sale, it is understood, through some misunderstanding, was made at \$30.70, f. o. b. tidewater, instead of \$30.80, thus fixing the quotation, which has since ruled. By the terms of the agreement the services of the broker were done away with, thereby giving the roads making the purchases the benefit of the commissions usually paid. Almost immediately the market solidified at \$30 to \$30.70, at which figures it has ruled very firmly. The organization was regarded with anything but favor by the railroads, which prophesied that it was destined to fill an early grave. Early in March a slight disagreement arose in the combination owing to a hitch in the negotiations for consolidation between the Scranton Steel Company and the Lackawanna Coal and Iron Company. It was amicably settled, however.

The demand during the year has been light. The railroads, although in need of rails, were so poverty stricken that they could not buy, and they claimed, with a semblance of truth, that they were waiting for the break in the combination. An era of prosperity has been enjoyed by almost all the lines during the last quarter of the year. The *Financial Chronicle* in a recent issue figures that 146 roads show during October a gain over the corresponding time in 1890, in gross earnings, of \$5,750,000. "This is not only larger than in any other month of the present year, but has rarely been exceeded. The ratio of increase has been steadily rising, the increase of 8.70% for October comparing with 7.46% for September and 4.92% for August. In the net earnings the gain for the month reached \$2,722,350, or 10.80%. In September the increase in the net earnings was only \$2,329,352, or 10.32%, and in August but \$1,177,192, or 5.52%."

The Pennsylvania Railroad Company was the first to place its order, amounting to about 60,000 tons, for 1892. Other buying followed, but it consisted of light orders with an option for a considerable amount in 1892, at the present ruling quotations. This action of the manufacturers in giving these options as stated established the belief that present prices will rule during at least a great portion of 1892.

That the prospects are bright no one will gainsay. The roads have generally neglected for three years much needed repairs, and it is believed they will soon be in a condition financially to make these.

During September an important factor entered the market in the formation of the Maryland Steel Company, of Sparrow's Point, Md. Up to that date the plant, then building, had been owned by the Pennsylvania Steel Company. A separate organization became necessary under the laws of Maryland, and desirable, in order that the works might obtain a separate proportion of the allotment. A readjustment was effected by which, it is understood, the Maryland Steel Company obtained 8% of the total output, which percentage was made up on a surrender by each company having over 8% of a pro rata percentage of such excess. The Maryland Steel Company has not as yet figured in the market to any great extent, but it promises to become an active producer. The mill is situated at tidewater, and obtains its raw material cheap. Consequently, \$30.70 tidewater is equivalent to \$30.70 at the mill, thus clearly giving it the advantage of 70c. on tidewater sales.

The combination by strict adherence to prices, in the face of a very light business, has proved its strength. At various times during the year many of the mills have worked one turn. The short lived difficulties with the Amalgamated Association of Iron and Steel Workers enabled them to curtail operations during the duldest period. The manufacture of steel billets has served as a balance wheel to keep machinery in motion at times when orders were slack. The association reports that orders for 1,119,000 gross tons had been booked to December 1st for 1891 delivery. This is to be compared with 2,111,544 tons made during the 12 months of 1890.

Rail Fastenings.—The market has been remarkably quiet. Considering the little business offering, as compared with the large capacity of the mills, prices have been very steady. The following table will show the range of fluctuations:

	Spikes.	Angle plates.	Bolts and square nuts.	Hexagonal.
January.....	2'00 C. 2'05@2'10*	C. 1'70@1'80	C. 2'75	C. 3'00
Feb'y and Mch.	2'	1'70@1'80	2'65@2'75	3'00 2'85
April.....	2'05@2'10	1'70@1'80	2'65@2'75	2'85
May.....	1'95@2'1'90@1'95	1'70@1'80	2'65@2'75	2'85
June.....	2 2'10@2'15*	1'70@1'80	2'65@2'75	2'85@2'95
July.....	2@2'10 2'15*	1'70@1'80	2'75@2'85	2'95
Aug. to end of Year.....	2'10@2'15	1'70@1'80	2'75@2'85	2'95

* Nominal.

Several attempts were made during the year by spike manufacturers to bolster up prices. Each resulted in an advance of from 5c. to 15c. However, the business doing was too light, and interests of a nature too conflicting to permit of any permanency, and a drop to the original level followed in each case. Prices fluctuated up to October. During the remainder of the year a higher schedule ruled. This enabled dealers to obtain good figures on small orders, the understanding being that concessions would be made on large lots. During the year the steel mills demonstrated their ability to manufacture angle plates much more cheaply than mills which make it a specialty, owing to the fact that their raw material is obtained from rail waste. Their close relation to rail consumers has afforded an excellent market, which has been utilized to give the buyer a concession which might be considered a reduction in the price of rails.

Spiegeleisen and Ferro-Manganese.—Prices for spiegeleisen and ferro-manganese are on bed rock. The demand, which is wholly conditioned upon the Bessemer steel industry and largely upon the steel rail trade, has been exceedingly dull, with abundant stocks. In 1889 80% ferro-manganese sold at \$105 per ton. During that year the enormous demand caused a marked extension of works. In January, 1890, it sold from \$95 to \$105, but owing to a falling off in the demand it declined to \$66.75 per ton in December, selling during that year at the average price of \$79.30. It opened in 1891 at \$65.00, and in the face of a very slack demand sold down as low as \$61.50. The range of fluctuation was \$3.50 for the year, against \$33.85 in 1890. An attempt was made in August by a combination of producers to advance the price and the figure was nominally fixed a \$64.50, against the then ruling quotation of \$63 to \$64. The organization was short lived, however, and the reaction which followed brought the price down to \$61.50 in December.

The course of the spiegeleisen market has been influenced by the same general conditions. It opened the year 1890 at \$37 to \$39.50 for 20%, selling down steadily to \$31 to \$29 in December. Entering upon the year 1891 at \$29, it ruled at this figure for four months, thence going to \$28, and later to \$28 to \$27.50. The average price during the year was \$28.15.

Merchant Steel.—The merchant steel trade has been satisfactory. Prices have ruled fairly steady. The year opened at, per 100 lbs.: R. Mushet's special, \$48; best English tool, \$15; American tool, \$7.50 to \$10 special grades, \$13 to \$20; crucible machinery steel, \$5; crucible spring, \$3.75; open hearth machinery, \$2.60; open hearth spring, \$2.60; tire steel, \$2.60; toe calks, \$2.60; flat file, \$4.50; mill file, \$4.50; taper file, \$7; first quality sheet, \$10; second quality sheet, \$8. Fluctuations have been light. In July open hearth machinery, spring and toe calks weakened 10c. to \$2.50, and again in December the two first mentioned dropped 25c. to \$2.25. In September crucible machinery dropped 25c. to \$4.75. Contracts are being quite generally renewed on the same basis of prices.

In instituting comparisons with 1890 it is found prices were the same, with the exception of a decrease of 15c. per 100 lbs. in open hearth spring, 25c. on flat file, and 50c. on paper file. The outlook for 1892 is very favorable.

Structural Iron and Steel.—The financial stringency of the past year has particularly affected the structural iron and steel trade. General building operations have been restricted, nevertheless there has been a steady consumption. While bridge building has fallen off, the growing tendency to put up heavier structures has afforded an enlarged consumption. The following prices have ruled almost unchanged, universal plates, \$2.20; bridge plates, \$2.15; angles, \$2.20; beams, \$3.10. The local market suffered a decided setback in the spring, owing to the industrial strikes, which in one phase or another continued throughout the summer, causing many who had intended to build to postpone such action till 1892. As other features of the local trade might be mentioned the very firm front maintained by the Beam Association in the face of the threatened move of certain consumers to introduce foreign beams on the local market to the exclusion of the American product.

The midsummer serenity and dullness was disturbed by the action of certain rolling mill companies, which made a bid to deal directly with the builder, thus ignoring the contractor. It seems that it was customary for these mills to supply the steel columns and beams, allowing the iron workers to furnish the cast iron portions. The latter class objected to this, as evidenced by a bill which they sought to put through the New York State Legislature, prohibiting the use of certain grades of iron and steel. The steel men secured the introduction of the following amendment: "The factor of safety in the case of all columns, posts or pillars shall be not less than one to five for such columns when made of cast iron, and as one to three for such columns when made of wrought iron or rolled steel." Later the bill was killed in committee.

In certain sections of the West, notably Chicago, the consumption of structural material has been enormous, and a considerable portion of these orders have been placed among Eastern mills.

Tubes and Pipes.—The market during the first half of the year was fairly active, and steady at about the following range of discounts from

circular rates: Butt black, 47½%; galvanized, 40%; lap black, 60%; lap galvanized, 47½%; boiler tube, all sizes, 50%. With the opening of fall business competition became keen and was characterized in many quarters by cuts. The association, forced to recognize the condition of affairs, increased its discounts in August as follows: Butt black, 52½%; galvanized, 42½%; lap black, 67½%; lap galvanized, 55%; boiler tubes under 3 in. and over 6 in. 55%, from 3 in. to 6 in. 60%. These rates ruled nominally during September. Concessions being the order of the day a further advance was necessitated in October, and the following circular of discounts was established: Butt black, 57½%; galvanized, 47½%; lap black, 67½%; lap galvanized, 55%; boiler tubes from 3 in. to 6 in. 60%, all others 55%. These are the quotations in force as we go to press.

The event of the year was the reorganization of the National Tube Works Company under the laws of New Jersey. The capital stock of the new company is \$11,500,000; one-half 7% preferred accumulated stock and the remainder common stock. It represents the value of various plants, divided approximately as follows: National Tube Works Company, \$9,000,000; Monongahela Furnace Company, \$555,000; Republican Iron Works, \$1,000,000; The Boston Iron and Steel Company, \$950,000.

Old Rails.—The quantity of old iron rails which is being offered for sale is becoming scarcer each year. The reason therefor lies in the fact that the supply is rapidly being exhausted. During the early part of the year they were worth from \$22 to \$23, later they sold for \$21.50 to \$22.50, and can be bought to-day for \$20.50 to \$21.50. Old steel rails have not figured in the market to any great extent.

THE CHICAGO IRON MARKET IN 1891.

(From our Special Correspondent.)

The year opened very unsatisfactorily to the iron trade interests in the West, the primary cause of which was the great Baring failure in England, which threw large blocks of American securities back to this country. Railroads were more or less embarrassed, and all were compelled to adopt a policy of rigid economy. Retrenchment on all sides was the order of the day, extensions were abandoned, new projected lines shelved, and the outlook from a railroad standpoint was exceedingly dubious. The consequence of the severe stringency of the money market, affecting, as it did, nearly all branches of the iron and steel trades, was the blowing out of many of the coke and charcoal iron furnaces, North and South. Thus the heavy production of pig iron which characterized the market during the latter part of 1890 was greatly reduced. The shutting down of the furnaces was the only salvation, as stocks were enormous and steadily accumulating and consumption as steadily decreasing. Hence in a short time the output was reduced some 120,000 tons a month. Consumers from the first adopted a conservative policy and the buying on all sides was of a hand-to-mouth character. At the mines in the Lake Superior regions the same restrictive policy was observed throughout the entire year, the result being an output of about 6,000,000 tons or about 4,000,000 tons less than in 1890.

Pig Iron.—The general tendency of the market has been downward, but crude iron has been less affected in a general way than has the finished material. The January Lake Superior charcoal iron was selling at \$18.50. It receded by almost imperceptible gradations until in November it touched bottom at \$16, but recovered quickly to \$16.50 to \$17 during December. Northern coke iron opened at \$16, \$15.50 and \$15 respectively for Nos. 1, 2 and 3, and to-day is quoted at \$15.50, \$15 and \$14, and Southern iron 50c. to 75c. less. It will be seen from the foregoing that prices on pig iron may be said to have been on the whole fairly steady. In February consumers requested furnaces to hold back on shipments, but in March began to take iron more regularly. The same was again noticed toward the close of the year. But throughout the past 12 months there has been at no time any particular activity, outside of regular season's contracts by implement, malleable iron and car wheel men.

Structural Iron and Steel.—The labor strikes early in the year had some effect on the demand for structural and several plants were in enforced idleness on account of the limited demands for the finished material. But later in the season demand revived and has been fairly active until the close of the building season. Prices have been very steady, receding only about two-tenths to three-tenths.

Bar Iron.—Bar iron was very quiet at the opening of the year at 1'65c., at which figures it is now quoted. The fluctuations during the entire year either way have not exceeded \$2 per ton—lowest 1'55c., highest 1'75c. The demand has been such that mills generally have been well employed. One mill in this district failed and was recently sold by the receiver, and another shut down until demand and price improve.

Plates.—Plates have been in fair demand from agents, but these, too, have been on the downward grade; they were quoted at \$2.60 iron and \$2.65 for steel in January but are now \$2.20 for both.

Black Sheets.—Black sheets and galvanized sheet iron have shown very little fluctuation either in demand or value; the latter though on account of the World's Fair has been particularly active during the past few months, supply of standard grades being entirely inadequate to the demand. The variations in price of black sheets has not exceeded \$2 per ton, and 5% to 10% discount on galvanized.

Merchant Steel.—Merchant steel has held its own remarkably well, both as regards price and demand. Agricultural implement manufacturers and dealers were cleaned out of stock early in the season, the immense crops requiring everything in sight, and many fields of grain were left standing on account of inability to get machinery. Hence during the latter part of the year orders were exceedingly heavy for everything comprised under the caption of merchant and plow steels. As to prices, outside of those denominated "Association," the variations will barely exceed 25 to 50c. per 100 lbs. The tendency now is on the upward grade, and already some slight advances have been made by mills turning out specialties in the implement and special manufacturing branches.

Steel Rails.—The formation of the Steel Rail Association checked the competition which had begun to develop. Prices were placed at \$30 at Eastern mills and \$31 at Western mills; these were minimum. The inability of railroads to buy for their actual requirements was a serious drawback to the steel company here, but it put in a large steel rod plant at

Joliet and thus utilized a fair portion of its Bessemer output. Demand for steel rails was light for the first eight months of the year, then the turn came, and the past three months have shown a heavy buying movement on the part of railroads. The tonnage booked here for forward delivery exceeds 150,000 tons, with a strong probability of a large addition. Other track supplies during the year have been on a parity with the orders for rails.

Old Materials.—Old iron rails have been in very moderate demand throughout the year. In January they were quoted at \$33, with slight fluctuations up and down, and are now quoted at \$21.50. Old steel rails have been much the same, demand limited and prices ranging from \$14.50 to \$16.50 for short and long lengths respectively in January, and are now quoted at 13.50 to \$15.50. Old car wheels have been generally dull at \$18 in January and \$15.75 December. Scrap iron has remained very steady; the variations for the entire year have not exceeded \$1. No. 1 wrought was \$19, now it is \$18. Other grades in like proportion. Demand was fair to good during the first few months, but has gradually declined on account of the failure of one mill and the closing down of another.

Nails.—Both steel cut and wire nails have been in moderately good demand, though prices have steadily declined. Steel cut were \$1.70 and are now quoted at \$1.60, regular average. Wire nails show a much greater decline; were \$2.15 and are now \$1.85. In both of these overproduction and general weakness of the iron and steel markets were the causes.

Wire.—The purchase of the barb wire patents by the Columbia Patten Company from the Washburn & Moen Manufacturing Company has been a material benefit to barb wire makers. Prices are now held firm, and are the same to all large purchasers.

During the latter part of the year extensions to old plants, the location of new industries, the formation of manufacturing town sites both inside and outside of the city limits of Chicago have added greatly to her prosperity; all this, too, without taking into consideration the location of the World's Fair at this point. Without a doubt we are on the eve of the heaviest demand for iron and steel products ever experienced in this country, and the coming year will verify our prediction.

THE PHILADELPHIA IRON MARKET IN 1891.

(From our Special Correspondent.)

The eastern Pennsylvania iron trade in 1891 presents several peculiar and interesting features, chief of which are the regularity of prices throughout the year and the unusual fluctuation in production, reaching as high as 25%. Speaking generally, there has been a steady decline in the output of anthracite pig iron during the past two years. In the early weeks of 1890 it was in round figures between 47,000 and 48,000 tons per week. The lowest figures were reached in September of that year, when the output had fallen off 10,000 tons per week. From that time until the close of the year there was a steady expansion of about 100 tons per day, when the output at the opening of the present year was a little in excess of 43,000 tons per week. Since then there has been a decline, until the lowest production of the year was reached in August; but subsequently the output has been increasing. A somewhat similar course is shown in the production of bituminous iron, but this report is not directly concerned with these details. The same causes seem to operate in both lines of production. The most interesting feature of the industry at present is the increasing production, which will be augmented very soon by the new furnaces soon to be at work. The bituminous iron output can be very largely increased in this way, but the anthracite output is limited practically by existing capacity or the improvements which may be made in old furnaces. At present, considerable anthracite iron capacity is idle. A rough estimate of it is 15,000 tons per week. This does not include much capacity that is virtually out of reach, but only such capacity as might be set to work under the presentation of an active demand at present prices; or possibly a slight improvement on present prices. While the anthracite expansion may be put at 15,000 tons per week under normal conditions the possibilities of expansion in coke irons are limited only by the possible demand for them. The capacity at present prices may be safely estimated, including the furnaces soon to blow in at, coke, 155,000 tons; anthracite, 50,000 tons; charcoal, 15,000 tons; total, 220,000 tons per week, or, disregarding repairing stops and accidents, 11,500,000 gross tons per annum. New furnaces are being seriously projected. There is a deep conviction in the minds of thousands of enterprising men and promoters that the country's requirements will soon make a sudden jump of 20%.

A good deal of repairing has been done in the anthracite furnaces during the past year. The fact is recognized that there is not much chance or room for new furnaces, and the old furnaces are being made the best possible use of. Nearly the entire production has been sold in advance and this policy will be adhered to as closely as possible in the future. According to the best sources of information the stocks of anthracite iron are under control and are not above the usual limit. The weekly reviews have shown the weekly fluctuations and difference in tone of the market. The only noticeable fluctuations have been in steel billets, prices of which are from \$2 to \$2.50 less now than at the opening of the year, the reasons assigned being the increased capacity, the moderate demand for rails, and the pressing competition. Billets are now at their lowest point, and despite that fact orders for future delivery are of moderate dimensions only. Muck bar capacity has been in excess of the market needs and hence prices have been in favor of buyers for several months past and at the close of the year the only signs of improvement are the possibilities of a general iron trade expansion, sufficient to give abundant work to all.

The merchant iron makers have had a rather hard year. They might be more contented if at the very low prices they had been kept busy; but with low prices came irregular demand. A year or more ago considerable rolling mill capacity was added, but the demand did not keep up, and hence prices fell to a barely remunerative basis, where they are now and must remain unless car building and some other requirements should expand very considerably during the winter months.

The nail trade has been greatly depressed as to prices. A falling off in building affected demand materially. Western competition also made

itself felt. The actual figures of production cannot be known until the official statement appears, but from conflicting statements gathered in trade circles it would appear that the production of the present year is equal, so far as cut nails are concerned, to last year's. Stocks are quite large in factories, and every expedient has been resorted to to unload stocks on the market.

The sheet iron makers have no cause to complain, although business has not been quite as satisfactory as last year. Capacity has been increased, and competition has contributed somewhat to the crowding down of prices. The pipe makers have preserved the outward form of harmony, but prices have been steadily sagging all the year, and prospects are not especially favorable for the coming year. The plate mills, as well as the structural material mills, have been running all the year at a quiet, steady pace, turning out pretty nearly the same amount of material each month, and at about the same prices. The production of all forms of steel will undoubtedly greatly increase, but it will be left to other sections than eastern Pennsylvania to make the progress in that direction. The steel rail makers have had, generally speaking, about as good a year as last year. Those mills that turn out light sections have done better. The companies which have offices in this city report that the present prospects for next year are much more favorable than at this time last year. A great deal of railroad building may and may not be started, and until the uncertainty is removed makers have but little more to say. Prices have hugged \$30 throughout the year. Old rails have dropped \$1 since January. The machinery makers have done a good year's business, especially those engaged in electrical equipments and shop work. Buyers generally incline strongly to the belief that there will be more activity in all lines next year, but they also show by their cautious course in placing orders that they think capacity will take care of them, and that there will be no positive advance in prices.

THE PITTSBURG IRON MARKET IN 1891.

(From our Special Correspondent.)

The sales of raw iron in Pittsburg the past year beat all previous records, and shows pretty conclusively that this is the great iron and steel market of the country. The sales were 2,046,884 tons, which exceeds the previous year by 451,114 tons. The increase in the iron trade the past five years has been wonderful. In 1887 the year's sales amounted to 916,974 tons, the present year exceeds that amount 1,129,910 tons. In the following table are given the weekly sales of raw iron in this market, compiled from the weekly reports of the ENGINEERING AND MINING JOURNAL.

WEEKLY SALES OF RAW IRON IN PITTSBURG, FOR FIRST HALF OF EACH YEAR FROM 1887 TO 1891.

	1887.	1888.	1889.	1890.	1891.
	Tons.	Tons.	Tons.	Tons.	Tons.
January 7.....	32,850	11,440	23,970	50,225	21,551
" 14.....	33,750	11,135	15,153	37,890	13,266
" 21.....	28,190	9,360	13,575	32,500	21,415
" 28.....	31,595	8,335	13,215	26,655	28,830
February 7.....	40,685	11,890	16,850	20,195	28,500
" 14.....	23,370	16,605	20,570	19,455	59,550
" 21.....	22,200	14,035	15,710	25,635	36,720
" 28.....	16,345	12,000	9,927	17,575	33,595
March 7.....	15,630	11,645	24,505	15,532	41,734
" 14.....	14,795	11,445	33,350	17,935	12,250
" 21.....	20,025	10,870	27,533	27,575	32,240
" 28.....	12,600	8,735	14,150	27,075	20,500
April 4.....	8,205	15,230	13,500	17,250	19,025
" 11.....	12,055	11,866	16,775	19,500	26,325
" 18.....	19,215	17,530	15,065	16,625	41,425
" 25.....	18,420	17,600	9,735	20,975	40,375
May 2.....	13,495	26,660	19,515	27,225	58,491
" 9.....	12,780	18,685	16,000	26,405	32,795
" 16.....	11,790	16,250	3,450	31,065	37,195
" 23.....	12,690	19,100	39,065	46,135	57,325
" 30.....	14,940	14,735	23,125	35,820	53,325
June 6.....	14,700	18,730	20,150	57,885	60,130
" 13.....	1,730	21,670	12,850	48,075	66,381
" 20.....	12,600	13,900	31,975	32,535	73,283
" 27.....	33,820	56,940	60,965	43,145	72,831
First six months.....	494,835	387,356	548,967	748,437	988,659

WEEKLY SALES OF RAW IRON IN PITTSBURG FOR LAST HALF OF EACH YEAR FROM 1887 TO 1891.

	1887.	1888.	1889.	1890.	1891.
	Tons.	Tons.	Tons.	Tons.	Tons.
July 7.....	12,665	14,410	22,475	28,950	61,705
" 14.....	24,735	20,590	28,735	26,950	55,825
" 21.....	28,455	40,380	40,225	22,355	50,965
" 28.....	24,005	22,725	51,125	29,755	29,145
August 4.....	16,680	27,925	45,805	13,450	31,455
" 11.....	12,890	30,955	45,275	42,250	28,691
" 18.....	18,000	35,175	62,225	34,820	15,025
" 25.....	17,225	31,275	40,380	46,555	26,400
September 1.....	17,310	24,270	58,665	35,610	54,320
" 8.....	16,460	43,000	27,920	57,850	37,312
" 15.....	19,035	29,140	36,083	44,150	56,910
" 22.....	22,890	32,800	31,270	43,500	51,228
" 29.....	13,945	19,000	60,650	29,440	48,250
October 6.....	18,020	28,255	100,420	27,185	58,425
" 13.....	14,884	24,845	96,645	23,960	35,570
" 20.....	13,910	29,515	60,800	27,820	29,495
" 27.....	14,175	32,375	64,025	61,450	40,245
November 3.....	13,870	19,925	55,205	39,605	42,000
" 10.....	13,425	19,560	30,530	41,450	48,080
" 17.....	11,625	27,345	43,715	55,450	100,825
" 24.....	11,165	37,000	62,495	30,630	53,430
December 1.....	13,345	36,220	64,665	17,525	49,525
" 8.....	16,685	24,520	81,020	34,000	52,890
" 15.....	12,145	23,425	51,415	15,135	.....
" 22.....	12,860	21,225	40,825	10,825	.....
" 29.....	11,225	24,790	67,520	29,420	.....
Second six months.....	422,139	722,509	1,374,083	847,333	1,058,227

RECAPITULATION.

	1887.	1888.	1889.	1890.	1891.
Sales first six months.....	494,835	387,356	548,967	748,437	988,657
Sales second six months.....	422,139	722,509	1,374,083	847,333	1,058,227
	916,974	1,109,865	1,923,050	1,595,770	2,046,884

SALES OF IRON ORE IN PITTSBURG IN 1891.

May 1st.....	350,000 tons at \$4.50 per ton.
" 20th.....	800,000 " " 4.50@\$.25 per ton.
" 27th.....	100,000 " " 4.75@ 5.00 "
July 10th.....	3,275,000 " " 4.25@ 5.50 "
	4,825,000

PITTSBURG CASH PRICES FOR GREY FORGE IRON FOR THE PAST FIVE YEARS.

	1887.	1888.	1889.	1890.	1891.	1887.	1888.	1889.	1890.	1891.
	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
January.....	20.50	16.50	15.50	18.25	14.25	18.50	14.25	14.00	15.50	14.10
February.....	20.00	16.25	14.50	18.00	14.50	18.50	14.25	14.50	15.50	14.00
March.....	19.50	16.00	14.75	17.00	15.00	18.00	16.25	15.65	15.25	14.10
April.....	19.50	15.50	14.25	15.25	14.25	18.00	16.50	16.25	15.25	13.87
May.....	19.00	15.00	14.00	15.50	14.12	17.75	16.00	16.75	15.00	13.60
June.....	18.25	14.30	14.00	15.75	14.15	16.75	15.50	19.00	14.75	13.50

PITTSBURG CASH PRICES FOR BESSEMER PIG IRON FOR THE PAST FIVE YEARS.

	1887.	1888.	1889.	1890.	1891.	1887.	1888.	1889.	1890.	1891.
	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
January.....	21.50	19.00	16.65	24.00	16.25	21.00	17.00	16.65	19.30	15.80
February.....	20.50	18.50	16.50	23.00	16.50	21.50	17.25	16.85	18.75	15.80
March.....	23.00	18.32	16.75	20.00	16.50	20.75	18.00	18.00	18.50	15.62
April.....	22.00	18.25	16.50	18.25	16.50	20.50	18.00	18.00	17.75	15.40
May.....	22.00	17.00	16.65	18.25	16.50	20.50	18.00	21.50	17.50	15.18
June.....	21.00	17.00	16.00	19.25	16.25	19.50	17.25	24.00	16.75	15.25

THE LOUISVILLE IRON MARKET IN 1891.

(Special report by Hall Bros. & Co.)

Looking backward and reviewing the iron market is comparatively an easy task as records and experience show for themselves, but to forecast the future is an exceedingly difficult thing to do; the legends of the past are teeming with sufficient illustrative examples to show that no one can prognosticate the future with any degree of certainty. The circumstances leading to certain conditions and developments one year may not appear at all during the next period, so there can be no special rule to go by, and predictions may be said to be based entirely on hopes or fears from personal interests, either directly or indirectly. The year just closing has been the most remarkable in some respects that history has recorded and differs widely from the preceding year; it is especially noted for the slight variation in prices, which in the line of coke irons has not exceeded \$1 per ton, while in 1890 prices fell off rapidly, the decline amounting to fully \$4.50. Another noticeable feature has been the complete absence of speculation in iron, but this is easily accounted for from the fact of the great stringency in the money market, which has prevailed for so long, and the banks declining to let out money for speculative purposes.

Almost throughout the entire year prices remained about the lowest in the history of the business. Charcoal irons for a while held up in prices with remarkable strength, but this character of metal had all along ruled relatively much higher than coke irons, and in due time the figures had to be materially reduced to meet the exigencies of the times; they have continued to rule very low, and in point of fact have in some instances been sold below the cost of production.

The aggregate sale in tonnage for the year under review has in most cases been satisfactory, but, taking the general markets as a whole, will doubtless fall considerably short by reason of the lethargic condition of the market which has prevailed throughout the year. That prices have run with so much evenness is remarkable in the face of the slow consumption and enormous production, which is now going on at the rate of 10,000,000 tons per annum. The exceptionally fine crops throughout the country, and the known large requirements of the railroads in new equipments to move these cereals and other commodities, it was thought would lead to placing orders for unusually large numbers of cars, steel rails, etc., and develop great commercial activity; all of which, however, has been greatly delayed by various causes, and as a result general depression has prevailed for a longer time and to a greater extent than for many years. The effects of the large crops and other recent influences may assert themselves later on, and revive matters, but the opinion is expressed that the depression that has weighed upon all branches of trade will continue to be felt for some months to come.

Considerable money will be turned loose about the first of January, which will be seeking investment, and matters will at least temporarily ease up and doubtless strengthen and open a market for many of the good securities which have so long lain dormant. The whole situation will of course right itself in time, but when the golden lucky morn will gild the gray dawn we know not; but if there is any efficacy in wishes, the heavenly rays would at once shed their welcome radiance. From all exterior appearances we can see nothing that is likely to occur in the immediate future to bring about any substantial advance.

MR. ANDREW CARNEGIE ON THE IRON TRADE.

(Report of an Interview.)

Mr. CARNEGIE: So the ENGINEERING AND MINING JOURNAL wants my views upon the iron situation. Go on and ask me the things your distinguished editor wishes to know.

Q. I. Statistics show that for five years following 1885 there was a constant and rapid increase in production and consumption of pig iron, the rate of production reaching its maximum in November, 1890. An enormous decrease ensued in the first half of 1891. To what causes do you attribute this decrease?

Mr. CARNEGIE: The enormous increase in the production of pig iron was caused by the fact that iron was going into many fields from which before it was excluded. The decrease in the first half of this year came directly from the failure of Baring Bros., although my opinion is that it would have come a few months later, certainly at the beginning of this year, had not that event occurred. I don't believe that the United States can use permanently the amount of pig iron which it is now producing. Although the maximum of November, 1890, is being exceeded by this November, 1891, still a great deficiency in the first six months of the year has to be made up, as compared with 1890.

Q. II. Returns now show that the production of pig iron has again increased to such a point that it exceeds the rate of production of November, 1890. Is this increase merely a making up for the time lost during the depression in the early part of the year and therefore temporary, or is it due to the increased crops and general increase of wealth of the country and therefore likely to continue, so as to make the production in 1892 larger than in 1890?

Mr. CARNEGIE: I have partially answered that in my answer to your first question. No doubt the confidence inspired by our great crops and by the scarcity in Europe induces furnace proprietors to keep in blast,

because they believe times are to be prosperous, but my opinion is decidedly that the present production cannot be used very long.

Q. III. Statistics show that the tremendous increase in the consumption of pig iron from 1885 to 1890 did not at any time cause any serious increase in price, nor did the great decrease in consumption in the beginning of 1891 cause any great decrease in price, the price being apparently regulated not by the demand, but kept steady by the great surplus producing capacity of the furnaces, and by the idle furnaces ready to start in as soon as prices should rise in the slightest degree. Is the producing capacity of the furnaces still so far ahead of the probable demand as to cause it to still act as a regulator of the market and keep prices down, or are there any other causes which are likely to make an advance in price, notwithstanding the surplus producing capacity such as shortage in ore or fuel supply?

Mr. CARNEGIE: In reply to that I say, yes, that the great producing capacity of the blast furnaces will keep the prices of pig iron low. I don't mean that the present prices will be maintained, because I believe these are too low to net even a moderate return to many of the furnaces in blast, but, on the other hand, I don't think that prices for pig iron can really be high during next year.

In regard to the shortage of ore or fuel supply, there can be no shortage of either. America is blessed with plenty of fuel and of ore, and I think it probable that there may be some increase in the rates for transportation of ore in the West on the lakes; but a great deal of new shipping is being built there, and perhaps this will not amount to much. With Bessemer pig iron at \$15 per ton there is no margin to pay more for ore or fuel than present prices.

Q. IV. Edward Atkinson, in his recent paper on "The Future Site of Iron Production of the World," holds that there must be in the near future an increase in the price of iron on account of the enormously increased demand and the difficulty of producing the amount demanded. Are there any signs yet of failure of nature to supply sufficient ore and fuel, or of man's activity in building sufficient furnaces to smelt the iron which would warrant this belief?

Mr. Atkinson's paper, published two years ago, indicates that the southern part of the Appalachian range is to be the future great center of the iron production of the world. Have the facts of the progress of the industry since that time tended to establish the truth of his forecast, or the contrary?

Mr. CARNEGIE: My friend Atkinson is a great authority on everything he writes upon, except the tariff and, I think, the iron business in general. He is the head of the insurance business in this country; and if he will take me as responsible I would like to give him and everybody else a policy of insurance against lack of either ore or fuel or pig iron for the remainder of his natural life and of his son's life. I don't agree with him that the center of the iron production of the world will be in the southern part of the Appalachian Range. The Thomas-Gilchrist process of using iron ore with high phosphorus is too costly and the ore deposits of the Lake Superior region must be exhausted before the phosphoric ores of the South are of much value. It isn't where iron is to be made, but where steel is to be made; that is the question, and so far as I know the South unfortunately has not shown the necessary deposits of proper ore and fuel for this purpose. No doubt the production of iron will increase in the South, but the attention of the people of the South must be directed to the making of steel, and until they succeed in this we friends of the South, I fear, will not find its development what we could wish.

Q. V. Two years ago you said that "unless Pittsburg can free itself from railroad oppression I look to see Chicago become the future center of the iron and steel industry of the country." Since that time have the conditions become any more favorable for Pittsburg as regards the railroads? Is the failure of natural gas likely to do Pittsburg any serious damage as an iron center?

Mr. CARNEGIE: Chicago is really the only possible competitor of Pittsburg in the production of pig iron suitable for steel. As far as rails are concerned, we will be very sorry if ever it becomes necessary to invade the market of the Northwest in competition with Chicago, but Pittsburg is nevertheless the best distributive point in this country. Her water communications, her railroads in all directions, give her command of the great central and southern zones of this country. The new line which will soon be opened from Lynchburg to Pittsburg will give Pittsburg access to the entire Southeast in the thousand and one articles of steel manufacture, advanced to a stage beyond rails. The cheapness of fuel in Pittsburg will, I believe, enable the manufacturers of Pittsburg to reach the Chicago market under any competition. In open hearth steel, for instance, I think Pittsburg will continue to beat Chicago.

Q. VI. What do you estimate as the probable total rail production of 1891? Is the consumption of rails now due most largely to the building of new railroads or replacing old rails? What is the outlook of the rail trade for 1892? Is the change from 65 lb. rails to those of heavier section likely to cause any great increase in the rail demand?

Mr. CARNEGIE: I think about a million and a half tons of rail will be used this next year. The outlook for rails is good, and the railroads are at last finding out that much heavier rails are necessary: of course this increases the tonnage.

Q. VII. It appears by the statistics that rail production is continually becoming a less important branch of the iron manufacture, the percentage of rails to pig iron made decreasing. Is this tendency likely to continue?

Mr. CARNEGIE: Certainly it is to continue. It is impossible that the railway system of America can take more tons of steel rails than all other sources of consumption. Rails will no doubt remain the largest single item, but that is all.

Q. VIII. Does the erection of iron and steel buildings in cities yet call for any large percentage of the iron and steel product, or is it still a relatively insignificant item in the trade?

Mr. CARNEGIE: Certainly the use of structural steel is increasing, but the total amount in tonnage is surprisingly small. Our own facilities would make all the structural steel used in the United States.

Q. IX. Is the new tin plate industry likely to absorb any large amount of iron during 1892?

Mr. CARNEGIE: I know very little about the tin plate industry. There seems to be quite a number of new works starting, but it would take more than a year to bring them into full operation, I don't think, therefore,

that the industry will absorb any large amount of ore during next year.

Q. X. Are the Government requirements for ships, armor, ordnance, etc., likely to become a very important element in the iron and steel industry?

Mr. CARNEGIE: No, sir, it is impossible that the wants of the Government should make any figure at all. The total amount of armor required by the United States Government for all the shipping building, and authorized to be built, is about 15,000 tons, equal to 10 days' work of our rail mill. We have one mill in Pittsburg upon which we roll this armor, and we should like to take a contract to supply all the wants of all the Governments of the world. It is the labor necessary upon an armor plate after it is rolled that makes it cost. No concern in the world has yet made an average of 15 tons per day of armor. That is beyond the capacity of Campbell & Co. and John Brown & Co., in England, or indeed any maker in the world.

Now that I have answered all your questions, let me say that about this time last year I predicted that the maker of iron and steel during this year who balanced his books and showed interest upon capital would have reason to spend a very happy Christmas. I am sorry that, with the exception of two or three specialties, this prediction is verified by the prevalence of the lowest prices on record for all kinds of pig iron, plates, etc. Now, in the rôle of prophet for next year, I predict that prices cannot remain so low as at present. With the opening of the year a stiffening in prices will take place; there will probably be a greater boom in shares upon the stock market than in the prices for iron and steel; but manufacturers, as a whole, seem likely to have a prosperous year; and it looks as if when they balanced their books for 1892 that these will show a moderate, perhaps a satisfactory, profit; but I don't believe that any great advance in the prices of any articles of iron and steel will take place until the country has grown up to its present surprising capacity. All the signs are good, while last year all the signs were bad.

THE IRON AND STEEL TRADE IN 1891.

(By Robert W. Hunt, President of the American Society of Mechanical Engineers.)

I presume I was not alone in being disappointed with the commercial results of the iron and steel business of the country for the year of 1891. At all events, I must acknowledge to having expected very different conditions; but before the year was far advanced I was convinced of my error. I have observed that when a year opens badly, and hope is entertained that each of its succeeding trade seasons will improve, such expectation is generally not fulfilled, and we have to wait for the influences of a new year to turn the tide. Such was certainly the case in 1891.

The prospective conditions of 1892 have already asserted themselves, and this time I believe we are safe in looking forward to a busy year in the iron and steel trades and all their collateral industries. Probably there will be a greater improvement in the volume of business than in prices. It is much easier to lower the latter than to raise them. This is perfectly natural. Of course, one of the first effects of competition and a close market is to stimulate inventions looking toward cheaper production and the exercise of economy in all its details. The results frequently secure some profit where none was anticipated. Even when this is not so, it requires a demand greater than the supply to create a marked advance. Combinations may control natural conditions to a certain extent, but it is not safe for them to venture too far.

The steel rail production of the past year will show about 40% less than that of 1890. Instead of weakening the efforts of the respective mill managements, the narrow market stimulated their every energy. This resulted in alterations and improvements in machinery and methods which enabled them to both cheapen and increase production. Underlying every other detail, lower priced pig metal was a necessity, and this was obtained through cheaper raw materials and effective blast furnace methods. While I do not know of any startling developments in that branch of metallurgy, great and good work has been done. Given cheaper metal, the Bessemer and rolling-mill managements have made good use of it.

I do not believe there is any economy in spasmodic "big runs" *per se*. Their good effects come from demonstrating the possibilities of the plants, and thus leading to a regular increased output. If in one 24 hours over 1,200 tons of rails have been produced, it is pretty difficult to show cause why the same works should not average 1,000 tons every like period; and there does not seem to be any limit to the possibilities of such arguments in the Bessemer and other grosser steel manufactures. This does not apply to wrought iron. On its throat the powerful hand of the puddler still rests.

I will not attempt to give a record of all the big work accomplished by the various Bessemer and rail plants of the United States; in fact, much of it has been already published in more or less complete form, but by way of compiling the more notable instances of increased productions I name the following:

The South works of the Lackawanna Iron and Steel Company have but two converters. While this plant was the property of the Scranton Steel Company, and under the management of President W. W. Scranton, large products were constantly obtained in them. That the same spirit animates the present management was manifested on December 18th, 1891, when in 12 hours, or to be very exact, 11 hours and 54 minutes, 65 heats were blown, yielding 624 gross tons of ingots. I believe this to be the works' best record. In the same time the rail mill produced 1,591 rails of 80-lb. section, or about 560 gross tons.

In October, 1891, the South works of the Illinois Steel Company made its best record. The Bessemer plant consists of three 10-ton converters, and most of the metal is taken direct from the blast furnaces. The best detailed work of the month was: In 8 hours, 674 gross tons of ingots; in 12 hours, 1,006 gross tons of ingots; in 24 hours, 1,914 gross tons of ingots; in a week, 10,045 gross tons of ingots; for total month, 42,638 gross tons of ingots; the greatest number of heats blown in 12 hours was 91. The best record of the rail mill of these works is: In 12 hours, 845 gross tons; in 24 hours, 1,571 gross tons; in week, 8,152 gross tons; for month, 34,381 gross tons.

The Edgar Thomson works of Messrs. Carnegie Bros. & Co., have four 15-ton converters, and depend on direct metal which has passed through

a Jones mixer. Their best record was made in November, 1891. It was as follows: In 12 hours, day turn, 1,087 gross tons of ingots; in 12 hours, night turn, 989 gross tons of ingots; for the 24 hours, 2,076 gross tons of ingots. The night turn was delayed waiting for iron. The rail mill on the same day made of 70-lb. rails: On day turn, 3,022 rails, weighing 941 gross tons; on night turn, 3,173 rails, weighing 992 gross tons; for the 24 hours, 1,933 gross tons. From various causes there were delays in the mill during the 24 hours amounting to 3 hours and 20 minutes. The mill's best record for a month still remains at 33,181 gross tons.

With such capacities, it is evident that the rail consumption of the country must be increased beyond anything of the past to keep all the rail mills fully employed.

As previously intimated, increased and cheapened production has been obtained in many branches of the trade, and must exercise a powerful influence against any great advance in prices.

THE PROSPECTS OF THE IRON TRADE; VIEWS OF JAMES WILLIAMSON & CO.

Some very weak spots developed during the year in prices of Southern iron, which has been offered much lower than the quoted prices would lead the public to believe. The last four months have shown a large increase in the production, and stocks are generally believed to be accumulating. Consumers are now buying very sparingly, and running with very small stocks. The trade generally, both in the raw and manufactured branches, are looking to the railroads to help them out of this rut. The *Chronicle* computes that the railroads are handling 30% more freight than in 1887 with only 10% more cars. If this is so, we cannot see but that they will be a large factor in increasing the consumption of all material that goes into car building (it is estimated it requires about four tons of iron to a car), and if an opinion can be formed from appearances and from orders already given by them, they will be in the market for large supplies in the next few months, which, with the usual demand in this growing country with its increasing population and many new cities, and their necessary wants of gas and water pipe, etc., will take up most of the surplus, making prices firmer and eventually higher. Prices have ranged steady during the year from \$16.50 to \$18 for the best brands of No. 1, while some of the Southern irons as stated above have been sold for much less. It is hard to forecast the future, but the trade is hoping for a more active and higher priced market for 1892.

THE SOUTHERN IRON AND STEEL TRADE; VIEWS OF MR. JAMES BOWRON.

From the standpoint of a Southern observer, the condition of the iron and steel trade in the South is very unsatisfactory. We are passing through the purgatorial period which was pointed out one or two years ago. It has been evident to all unprejudiced observers that much unwise haste has been made in the South in the production of pig iron, for which there was no local demand. It is obvious that while 80% of the pig iron produced in the Southern States has to be sent away from home to find a market, competition must be exceedingly severe, and only those plants which are well located and possess every advantage can hope to survive. Numerous furnace companies have already fallen by the way and others are now sick unto death. It is discouraging to those who are in the trade to stay there, to have to compete in the sale of pig iron with those furnaces which have been put up to exploit the sale of town lots, and which are therefore compelled to realize from day to day to keep out of the hands of the sheriff, being wholly unable to make iron at a profit. In Tennessee and Alabama the mania for such construction of furnaces has been checked effectually, but a crop of new furnaces has developed in Virginia, and we must abide the results of their working before coming to a conclusion as to the probable immediate further development of Southern production.

In the meantime, this condition of things is not without some advantages; it has entailed compulsory economy, and Southern furnaces and mines are better handled to-day than they have ever been within the history of the trade. We have larger outputs, and better qualities of coke, of ore and of pig iron than ever before. Iron is being made more carefully to meet required analyses, and in the production both of high silicon irons, and of high phosphorus irons for basic use, the Southern district during the past year has taken an advanced position. The Southern Iron Company, at Chattanooga, has continued to produce open hearth steel, which has taken high rank for a variety of purposes. It has clearly passed the experimental stage. The same company during the year has rendered a further service to Southern producers of pig iron by extensive experiments in the production of basic Bessemer steel. These experiments have been entirely satisfactory so far as the nature of the experimental plant would permit. It is now manifestly only a question of the investment of sufficient capital to make the South a producer of basic Bessemer and open hearth steel on a large scale, instead of being confined, as hitherto, so closely to supplying the rest of the country with raw pig iron.

BRITISH IRON TRADE STATISTICS.

The half-yearly report of Mr. J. S. Jeans to the members of the British Iron Trade Association contain statistics of the output of pig iron and steel during the first six months of the present year. From this it appears that the total output of pig iron during that period amounted to 3,812,787 tons, against 3,706,666 tons in the last six months of 1890, which shows an improvement of 106,121 tons, or nearly 3%. As the stocks decreased from 1,367,248 tons on December 31st, 1890, to 1,295,572 tons (71,676 tons, or over 5%), the consumption of pig iron must have increased by about 175,000 tons over the six months.

The total output of Bessemer steel ingots during the half-year ended June 30th, 1891, was 923,005 tons, against 1,055,280 tons in the half-year ended June 30th, 1890. These figures show a falling-off for this year of 132,275 tons, or 12%. The decrease extended to nearly all the districts. The production of Bessemer steel rails declined from 510,459 tons in 1890 to 423,934 tons in 1891. In the output of open-hearth steel ingots there was an actual increase of 25,316 tons (3.3%), from 753,572 tons in 1890 to

778,888 tons in 1891. Coming side by side with the decrease in Bessemer steel, it is evident that the use of open-hearth steel is extending. The principal output in finished Bessemer steel other than rails was in bars, tees and forgings (132,840 tons), and blooms and billets (120,230 tons). While plates and angles of Bessemer steel only reached 43,223 tons, the production of open-hearth steel plates and angles was 291,367 tons, nearly seven times as great. The quantity of bars, tees and forgings of open-hearth produced was 134,400 tons; of blooms and billets, 100,481 tons; and of castings, 8,450 tons. There were also made 8,155 tons of open-hearth steel rails.

THE WORLD'S PRODUCTION OF PIG IRON, IN METRIC TONS (2204 LBS.).*

Country.	1888.	1889.	1890.
Great Britain.....	3,027,650	3,380,013	3,001,000
United States.....	6,595,741	7,727,839	9,348,000
Germany and Luxembourg.....	4,258,471	4,387,504	4,687,000
France.....	1,883,976	1,722,480	1,970,000
Belgium.....	826,984	847,000	782,000
Austria and Hungary.....	761,606	816,156	925,000
Russia.....	608,912	745,870	667,000
Sweden.....	457,052	420,665	421,000
Spain.....	260,000	220,000	232,000
Italy.....	12,538	13,473	13,000
Other Countries.....	100,000	100,000	150,000
Total.....	23,595,930	25,381,000	27,146,000

*The statistics for 1888 and 1889 are those compiled by James M. Swank, general manager of the American Iron and Steel Association, with the exception of the product of Russia which is from our own statistics, derived from official sources, and the product of Spain in 1889, which is estimated. The statistics for 1890 were compiled by Professors Jurashok and Lexis, according to whom the world's production of pig iron in 1840 was 2,900,000 metric tons; in 1860, 7,360,000 tons; in 1870, 12,065,000 tons; and in 1880, 18,385,000 tons.

LAKE SUPERIOR IRON ORE MARKET IN 1891.

(From our Special Correspondent.)

The year just closing has witnessed the lowest strata of prices ever reached in the history of the Lake Superior iron ore trade. Not many years ago, the man who would have prophesied that Lake Superior iron ore miners would ever bring their ore down to Lake Erie ports and sell it delivered there at prices which have ruled during the past season, would have been deemed insane. The ability, however, of the Lake Superior iron ore miner to meet these low prices to a certain extent—for it has been done during the past year, though at the expense of cutting down the product of the previous year about 2,000,000 tons—has been brought about by several conditions.

First—Large deposits of soft ore have been discovered in the Gogebic and Western Menominee district, which, owing to their great size and in many cases proximity to the surface, have been worked at a cost much less than was necessary to produce a ton of ore from the old hard ore mines of the Marquette County district. The mines of the Minnesota Iron Company and the Chandler Iron Company, owing to the great extent of their deposits, enabling them to be mined cheaply, and the superior quality, enabling them to command a maximum price in the market, have also been able to increase their product in spite of the hard times during the past year, so as to ship in the neighborhood of 900,000 tons, or a little more than in 1890.

Second—The reduction of 10c. a ton in the railway freight charged by the Chicago & Northwestern Railroad Company, which handles nearly one-half of the total product of the Lake Superior iron ore region.

Third—The low rates of lake transportation, which this year averaged about 30c. per ton less than in 1890.

These reductions, however, were not sufficient to enable many mines to meet the average reduction in price, as compared with the previous year, of \$1.50 per ton, delivered at Lake Erie ports.

In the fall of 1889 the enormous demand for ore on the part of the furnace men, for delivery in 1890, sent prices up \$1 a ton, as compared with those of the previous year. In 1891, however, transactions in iron ore were delayed as late as they were early in the previous year. Sales were not made until along in April, at which time the Illinois Steel Company and the Carnegie interests began to purchase large quantities of ore at prices showing an average reduction of \$1.50 per gross ton. Some ores sold at a reduction of not over \$1.25 and some at a reduction of \$1.75. In this way, therefore, the advance of the previous year was not only entirely lost, but a further decline of 50 cents per ton obtained.

As soon as the ore men were thus humbled, subdued and browbeaten, so that their backbone was entirely gone, and they sold their goods at almost any price which the furnace men chose to offer, sales were made freely in large quantities during the months of April, May and June. The prices which prevailed for the standard ores were about as follows: Republic, Minn-ota and Champion, \$5 per ton, a reduction of \$1.50; Aurora, Ashland and Norrie, \$4.25 to \$4.50 per ton, a reduction of \$1.25 to \$1.75 per ton; Chapin, Winthrop, Lake Superior "Old Mine Hematite," and other standard non-Bessemer hematites, \$3.50 to \$4 per ton, a reduction of \$1.50 to \$1.75 per ton; the standard non-Bessemer hard ores, namely, Cleveland, Lake Superior and Vermilion grade from the Minnesota mines, \$4.50 per ton, a reduction of \$1.50 per ton. Some non-Bessemer soft hematite ores yielding from 55% to 60% sold at remarkably low prices, it having been reported that as low as \$2.75 to \$3.25 per gross ton, delivered at Lake Erie ports, was reached.

When it is considered that the total cost, including commissions, postage, insurance, etc., even at the low rates of transportation then prevailing, equaled about \$1.70 from the mines of the Menominee and Marquette ranges to Lake Erie ports and \$2 from the mines of the Gogebic range and \$2.15 from the mines of the Minnesota range, it can be readily seen that the prices which ore brought on cars at the mine ranged from \$1 for the lowest grades to \$3.50 per gross ton for the higher grades.

Now, no mine produces only the higher grades. The production of most of them consists of a variety of grades, ranging from the lowest to the highest, so that no company received an average of \$3.50, the highest price above named, for its total product, f. o. b. cars at its mine. Some companies only produce the lower grades, and as it is a fact that the average cost of producing a ton of Lake Superior ore is in the neighborhood of \$2 per ton, exclusive of royalty, it can readily be seen that many a mine was operated rather for the benefit of its employes and the fee

owner of the land than for its stockholders. Although some new appliances, notably the power drill, have enabled mining to be conducted somewhat cheaper than it was fifteen years ago, and the greater knowledge of the geological formations, enabling the deposits of ore to be attacked and wrought in more skillful manner, have cheapened the cost somewhat, yet it must be borne in mind that as mines get deeper, and as the water to be pumped becomes greater in volume, so the cost from these causes inevitably increases. The Lake Superior mine owner, therefore, hardly expects from now on to effect a reduction in the present average cost of mining. He cannot, consequently, continue to produce ore at the present volume unless he obtains a better price f. o. b. cars at the mine than during the year 1891. This increase can be brought about either by a greater price at Lake Erie ports or by a reduction in the cost of transporting same from the mine. The furnace man, in the present condition of the pig iron market, will say that he cannot pay more for ore than he is now paying, consequently the price of ore will not advance unless the cost of transporting the same from lake ports to the furnace is decreased.

The lake transportation interests did not make any money to speak of in transporting ore during the past season. Even the latest additions to the steel ore carrying fleet on the lakes failed to make in many instances 6% to 7% on the cost, without allowing anything for depreciation. So lake freight rates cannot go lower.

It is generally conceded that the rail freight rate on iron ore from the mine to lake ports is too high; it stands to reason, therefore, that in the present low range of prices current in the iron ore and pig iron trade the railroad man is not standing his fair share. He should reduce his rates both from the mine to lake ports and from the lake ports to the furnaces. A determined and persistent effort was made in this direction by both furnace men and miners during the early part of this season, and it was cogently argued that if the railroads from Lake Erie to Eastern Pennsylvania would reduce their rates 25 cents per ton, namely, from an average of \$1.65 to an average of \$1.40, they would secure a large increase of Lake Superior iron ore tonnage, and by that means materially encourage the prosperity of the furnaces and mills on the line of their roads, many of which are now suffering from the want of good ores and from Southern competition. The railroads, however, did not see it in the same light, and refused to make the reduction. On the part of the roads from the mines to the lake ports only one was disposed to meet the mines in this matter, and that was the Chicago & Northwestern, which in July made a reduction of 10 cents per gross ton. This wise and liberal act on the part of the Northwestern Railroad was much appreciated by the mines situated on its line of road.

In view of the above presentation of affairs, it is safe to say that if it should happen during the present year that prices on iron ore could not be advanced, the production of 1891 would be still further curtailed in 1892. Mines which have continued to produce and ship ore during the past year at a loss, or a merely nominal profit, not having shut down on account of hopes of a better market this year, and of an unwillingness to lose their organization and discharge their employees, will, if the same condition of prices continues to another year, be compelled to either shut down entirely or greatly curtail their product.

Before the end of 1891 the enormous crops of grain which had to be moved to the East created a great demand for lake transportation in consequence of which freight lake rates on grain gradually rose until in November 8 cents and 9 cents per bushel was paid on wheat from Duluth to Buffalo. A small quantity of ore which happened to be uncovered, and which had to be moved down, was also forced to stand a considerable increase in lake freight.

The temper of the vessel men, therefore, is that they will not for the ensuing year take the season contracts which prevailed during 1891, and on which they lost money. They will prefer to run wild, unless they can get an advance in season contracts of from 25 cents to 50 cents per gross ton. With an advance of at least 25 cents per gross ton starting the ore man in the face in the cost of bringing his product to Lake Erie ports, he will unquestionably feel unwilling to sell for 1892 delivery unless at an advance of not less than 50 cents per gross ton. The furnace men are sufficiently posted to realize this condition of affairs, and already have been feeling their way to placing orders at last year's prices, in spite of the fact that prices of pig iron are lower than ever before in the history of the trade.

The enormous crops taxing the transportation capacity of the railroads to such an extent that the railroad companies are now placing their orders for 4,000 and 5,000 cars at a time, and commencing to purchase rails freely, induce the ore and iron men to confidently feel that prices will be better before long. Sales of ore for the new year will probably not be made before February of 1892, unless an advance of at least 50 cents per gross ton can be obtained.

I have not yet received the 1891 figures showing either the receipts of ore at Lake Erie ports or the total shipments from the mines. It is estimated, however, by competent authorities that the shipments from the mines will prove to be in the neighborhood of 7,000,000 tons, or 2,000,000 tons less than in 1890; and the receipts at Lake Erie ports will be in the neighborhood of 5,000,000 tons, a reduction, as compared with the previous year, of about 1,800,000 tons. There was on hand December 1st, 1890, at Lake Erie ports, 3,893,487 gross tons of iron ore. The estimated receipts during 1891, 5,000,000 gross tons, make a total of 8,893,487 gross tons. The estimated shipments from December 1st, 1890, to December 1st, 1891, are 5,900,000 gross tons, and the estimated amount on hand December 1st, 2,993,487 gross tons. If these estimates are correct, and I think they will not be far out of the way, it shows a very gratifying decrease in ore on hand, as compared with December 1st, 1890.

At present it is estimated that the furnaces in blast consuming Lake Superior iron ores have a weekly capacity of fully 20% greater than the average capacity of furnaces using the same ores during the year ending May 1st, 1891. If this furnace production continues, it is natural to assume that the shipments of iron ore to said furnaces will be greater in equal ratio. Shipments from Lake Erie ports for the year ending May 1st, 1891, were 5,478,869 tons. Add 20% to this and we arrive at a figure of 6,574,642 tons. Subtract this from the estimated amount on hand May 1st, 1891 (2,500,000), and the receipts for year ending May 1st, 1892 (5,000,000), a total of 7,500,000 tons, as above stated, and we will have on

hand at Lake Erie ports on May 1st, 1892, 925,358 tons, an amount which, at the present rate of shipments, is only two months supply for furnaces now in blast.

In my report published in the last annual statistical number of the ENGINEERING AND MINING JOURNAL, January 3d, 1891, I gave figures showing the receipts of ore at Lake Erie ports and estimates from same during the previous five years. Below find these figures repeated, including the estimated figures for the year 1891. The contrast of 1891, as compared with the previous years, is certainly very striking, and shows that the equilibrium between the demand and supply of Lake Superior ores is practically attained:

Year.	Receipts.	Shipments.	Excess. of receipts.
1886.....	2,270,554	2,353,022	82,468
1887.....	3,439,198	2,946,809	592,389
1888.....	3,783,650	3,433,975	289,694
1889.....	5,856,344	5,097,793	758,551
1890.....	6,874,664	5,588,283	1,286,381
1891 (estimated).....	5,000,000	5,900,000	900,000

* Deficit.

Transactions have been so scarce during the past month that it is difficult now to quote prices which can be relied upon. However, the following quotations for the small amounts of ore still unsold are probably not far out of the way:

SPECULAR AND MAGNETIC ORES.		
Bessemer, 66@69.....		\$5.25@6.00
60@64.....		4.25@ 5.00
Non-Bessemer, 66@69.....		4.50@ 4.75
57@60.....		2.75@ 3.75
SOFT HEMATITES, DRIED AT 212°.		
Bessemer, 62@65.....		\$4.00@4.50
58@61.....		3.50@ 4.00
Non-Bessemer, 55@63.....		2.75@ 3.25

IRON ORE SHIPMENTS FROM THE GOGEBIC RANGE IN 1891.

The season of 1891 on the Gogebic Iron Range has been, on the whole, rather unsatisfactory, on account of the stagnation in the iron market, resulting in comparatively slow mining operations at many of the mines and complete cessation of production or shipments in others. There has been, however, continuous work in exploiting and developing all along the Range, and several new finds have been made, which will be listed among the shippers in 1892. The shipments from the various mines on the Michigan and Wisconsin ends of the range have been as follows:

MICHIGAN MINES.			
Mine.	Tons of 2,240 lbs.	Mine.	Tons of 2,240 lbs.
Anvil.....	5,136	Jack Pot.....	1,540
Ashland.....	267,438	Newport.....	105,607
Aurora.....	83,552	Norris.....	753,774
Benjamin.....	1,200	Pabet.....	180,226
Brotherton.....	46,574	Palma.....	32,237
Colby.....	38,035	Sunday Lake.....	54,794
Comet.....	10,125		
Eureka.....	13,907	Total.....	1,562,105
Federal.....	5,000		
WISCONSIN MINES.			
Mine.	Tons of 2,240 lbs.	Mine.	Tons of 2,240 lbs.
Cary.....	53,416	Sec. 33.....	39,000
Cary, West.....	67,769	Superior.....	11,292
Father Hennepin.....	15,759	Windsor.....	1,453
Germania.....	27,849		
Iron Belt.....	3,000	Total.....	289,661
Montreal.....	70,113		

The grand total of shipments from the Range in 1891, including the Michigan and Wisconsin mines, is, therefore, 1,851,769 tons.

PRODUCTION, STOCKS AND SHIPMENTS OF IRON ORE IN 1889.* [In long tons]

States and Territories.	No. of mines.†	Amount produced.	Stocks, Jan. 1, 1888.	Stocks, Jan. 1, 1890.	Value of product.	Value per ton.	Total shipments.	Value of shipments.
Alabama.....	45	4,578,319	61,125	104,462	\$1,511,611	\$0.96	1,526,982	\$1,457,314
Colorado.....	18	1,099,136	1,628	7,193	487,433	4.47	103,571	469,546
Conn., Me., Mass.....	7	88,251	2,279	18,723	265,901	3.01	91,807	278,888
Del. and Md.....	14	29,300	7,298	14,476	68,240	2.32	22,202	54,469
Ga. and N. C.....	17	258,145	19,443	32,148	334,025	1.29	245,440	317,372
Idaho and Mont.....	7	24,072	1,893	4,216	158,974	6.60	21,749	140,647
Kentucky.....	4	77,487	17,290	16,491	135,559	1.75	78,286	133,885
Michigan.....	73	5,856,169	803,700	903,499	15,800,521	2.70	5,756,370	15,588,369
Minnesota.....	4	864,518	273,395	278,936	2,478,011	2.87	858,967	2,461,419
Missouri.....	8	265,718	251,091	291,790	561,041	2.11	225,019	470,457
New Jersey.....	24	415,510	98,249	94,890	1,341,543	3.23	418,869	1,352,569
N. M. and Utah.....	2	36,050	500	1,000	70,956	1.97	35,550	69,956
New York.....	35	1,247,537	158,223	85,890	3,100,216	2.49	1,219,870	3,028,676
Ohio.....	70	254,294	38,209	171,983	532,725	2.69	241,420	515,148
Ore. and Wash.....	3	26,283	3,575	2,740	39,231	1.49	27,118	40,389
Pennsylvania.....	189	1,561,234	82,322	91,989	3,063,534	1.96	1,550,567	3,045,100
Tennessee.....	16	463,294	29,863	16,844	606,476	1.28	486,313	629,454
Texas.....	2	13,000	200	4,300	19,750	1.52	8,900	16,540
Va. and W. Va.....	38	511,255	53,184	69,634	935,290	1.83	494,305	894,951
Wisconsin.....	16	837,399	23,357	46,669	1,840,908	2.20	814,087	1,798,403
Total.....	592	14,518,041	1,966,824	2,256,973	\$33,351,978	\$2.30	14,227,892	\$32,766,506

* From Eleventh Census Report. † Including mines producing during the census year only.

Production of Coal and Iron in France in 1889 and 1890.—The production of coal in France amounted in 1890 to 26,327,008 tons, against 24,303,509 tons in 1889, an increase of 2,023,499 tons; cast iron production rose from 1,733,964 tons in 1889 to 1,970,160 tons in 1890, an increase of 236,196 tons. Sheet iron, merchant iron, etc., increased from 807,695 tons to 823,219 tons, a difference of 15,524 tons. Steel rails increased from 165,764 tons to 173,930, while iron rails decreased from 1,029 tons to 141 tons. The total production of wrought steel increased from 529,302 tons to 566,197 tons, and that of Bessemer and Siemens-Martin ingots from 626,232 tons to 688,981 tons.

LEAD.

The lead production of the United States, which in 1890 met with a check, and even retrograded somewhat, has recovered its lost ground in 1891, and shows a larger output than ever before, passing far beyond the 200,000-ton mark, and exceeding the output of 1890 by nearly 24,000 tons.

The statistics have been furnished us by every smelter and refiner in the country, and may be relied upon as full and accurate.

The imports from Mexico, with a small amount from Canada and South America, have supplied about 22,000 tons of this output. The total production in 1890 was 181,494 tons of 2,000 lbs. and 1891 201,488 tons of 2,000 lbs.

The stocks of lead held at the close of the year did not exceed 5% of the production, and were about equal to those held at the beginning of the year. The entire production therefore went into consumption, for this country imported none during the year.

The average price of lead (4.35c. per lb., in 1891) was lower than in 1890, when it averaged 4.48c. per lb. The value of silver was also rather lower than in 1890, so that we can scarcely find in the markets the reason for the increased output. The production of spelter, which increased 15% during the year on the low average price of 5.02c. per lb. as compared with 5.55c. in 1890, and the output of lead, which increased 13%, and that of copper, which reached about 11%, though the average price declined from 15c. to 12c. per lb., would seem to demonstrate that consumption in each case was stimulated by the lower prices, and that the output increased chiefly because the market took promptly what was offered, and partly, no doubt, because the miners opened new mines or pushed the production of old ones, anticipating higher prices as the result of the higher duties of McKinley bill. For a short time indeed, toward the end of 1890, the price of lead was advanced by the McKinley bill, and the smelting charges on dry silver ores were also increased quite heavily owing to a temporary scarcity of lead fluxing ores, but a more liberal interpretation of the bill by the Treasury Department again allowed the Mexican lead ore to enter. The price of lead thenceforward declined (though smelting charges did not), and, as a final outcome, it must be apparent to every one, from a study of these statistics, that the McKinley Bill has been an injury rather than a benefit to the lead, and especially to the silver miners of the West.

This result must set some of the intelligent miners to thinking who profited when they were injured, or at least not benefited, by the legislation which they were told would prove so greatly to their advantage. But had Mexican lead ore continued to come in free, what would have been the result? Undoubtedly, the smelting of the Mexican ores would have been done in this country, to the obvious advantage of our metallurgical industry, instead of in works built with American capital in Mexico.

Lead might have ruled lower in price had very large amounts of ore come in from abroad, but this would have greatly stimulated consumption and would have kept down smelting charges on dry ores, the mining of which gives occupation to more men than does the mining of lead ores.

The statistics of production given herewith makes a roughly approximate distribution of the lead to the states where the ore has been produced. This cannot be done with exact accuracy, and the attempt may be misleading. The total production is, however, ascertained very closely and can be accepted as reliable, even though the proportion of it allotted to any particular state may be far from correct.

Colorado easily leads the lead producing states with an actual output of between 60,000 and 65,000 tons. Montana is increasing in importance and has never been more prosperous, and as the districts tributary to the Great Falls smelters are reached by railroads it will make a much more important record than it has yet shown. Idaho mines are also increasing in output though they are threatened with labor difficulties at present.

The prospect for the future in the lead industry is for a much larger production. The smelting capacity, especially in Colorado, is being greatly enlarged, and with improved processes and greater output the cost of smelting will be reduced, and no doubt smelting charges will go back to lower figures. The lower prices of lead will stimulate consumption to the benefit of other industries, and with a reflex benefit to mining itself. Great as is our lead production now, we expect to see it much larger, and to see this country become the metallurgical and manufacturing center for the Western hemisphere. The evident tendency of the times is toward freer commercial intercourse between nations, and certainly one of the first steps in this direction will be the free entry of raw materials, including ores. Our metallurgical industry will be wise to adopt itself to this and in its greater development our miners will find full compensation for local drawbacks. The greater and more varied the metallurgical industry is the more certain, steady and remunerative will be the market for ores of every kind.

PRODUCTION OF LEAD IN THE UNITED STATES.

Year.	Arizona and Cal.	Colorado	Idaho and Montana.	Mo. Kan. Ill. and Wis.	Nevada.	Utah.	Other States.	Total Production.
1873		56		22,381		15,000	5,103	42,540
1874		312		20,000		20,000	31,768	52,080
1875		818		24,689		19,000	15,123	59,640
1876		697		26,421		25,000	11,382	64,070
1877		897		31,152	19,724	27,000	3,127	81,900
1878		6,369		26,770	31,063	21,000	5,858	91,000
1879		23,674		28,130	22,805	14,000	4,171	92,780
1880		35,674		27,690	16,659	15,000	2,802	97,825
1881		40,547		30,770	12,826	24,000	8,942	117,085
1882		55,000		29,015	8,590	30,000	10,285	132,890
1883	3,200	70,557	11,000	21,600	6,000	29,000	2,600	143,957
1884	4,300	63,165	14,500	19,676	4,000	28,000	6,256	139,897
1885					3,500	26,000		129,412
1886		59,000	17,000	22,000	3,400	24,000	14,229	135,629
1887	1,000	63,000	27,000	28,000	3,400	22,000	16,300	160,700
1888	1,000	65,442	34,875	30,000	2,400	22,283	*30,000	186,300
1889	1,500	70,000	30,000	34,000	1,500	22,000	*31,000	190,300
1890	1,000	60,000	24,000	55,000	2,500	24,000	14,994	181,494
1891	1,000	64,000	25,000	40,000	2,500	25,000	47,828	205,488

IMPORTS OF LEAD INTO THE UNITED STATES FROM 1867.

Years.	Ore and dross.		Pigs and bars.		Sheets, pipe, and shot.		Old and scrap.		Total Value.
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
1867	611	\$25	65,322,923	\$2,812,668	185,825	\$9,560	1,255,233	\$53,202	\$2,881,677
1868	6,945	239	63,254,677	2,668,915	142,137	7,229	2,465,575	101,586	2,784,573
1869			87,865,471	3,653,481	307,424	15,531	2,983,272	123,068	3,810,965
1870	5,973	176	85,895,724	3,530,837	141,681	6,879	3,756,785	150,379	3,698,715
1871	316	10	91,496,715	3,721,096	86,712	4,209	2,289,088	94,467	3,828,512
1872	32,331	1,425	73,086,657	2,929,623	15,518	859	4,257,778	171,324	3,123,422
1873			72,423,641	3,233,011	105	12	3,545,098	151,756	3,406,372
1874			46,205,154	2,231,817			395,516	13,897	2,283,547
1875	13,206	320	32,770,712	1,559,017			382,150	13,964	1,599,679
1876			14,329,366	682,132			265,800	9,534	719,976
1877	1,900	20	14,583,845	671,482			249,645	8,383	682,168
1878			6,717,052	294,233			106,242	3,756	290,065
1879			1,216,500	42,983			40,243	1,153	45,275
1880			6,723,706	246,015			213,063	5,262	251,702
1881	5,981	97	4,322,068	159,129			153,018	2,729	163,465
1882	21,698	500	6,079,304	202,603			220,792	5,949	211,640
1883	600	17	4,037,867	130,108			1,094,133	31,724	169,958
1884	419	13	3,072,738	85,395	15,040	630	1,604,356	4,830	92,860
1885	4,218	57	5,862,474	143,103	971,951	22,217	4,866	106	166,855
1886	715,588	9,699	17,582,298	491,310	27,357	1,218	24,726	882	504,073
1887	153,731	21,487	7,716,783	219,770	27,941	1,286	136,625	4,323	247,168
1888	88,870	2,468	2,582,236	69,891	23,103	1,202	33,100	904	75,442
1889	328,315	7,468	2,773,222	76,243	35,859	1,417	50,816	1,494	87,919
1890	493,463	12,947	19,336,253	593,671	68,314	3,338	18,246,165	567,364	1,178,453

* Calendar years ending December 31st from 1886; previous years end June 30th.

TOTAL VALUE OF LEAD AND MANUFACTURES OF LEAD EXPORTED FROM THE UNITED STATES.

Year.*	Value.	Year.*	Value.	Year.*	Value.	Year.*	Value.
1817	9,993	1836	6,995	1855	19,531	1873	\$13,392
1818	22,487	1837	20,147	1856	33,140	1874	502,044
1819	7,549	1838	28,208	1857	63,442	1875	429,309
1820	1,799	1839	18,640	1858	75,416	1876	102,726
1821	3,512	1840	51,983	1859	167,357	1877	49,835
1822	4,244	1841	117,294	1860	106,527	1878	314,904
1823	3,098	1842	540,217	1861	36,775	1879	280,771
1824	1,136	1843	499,886	1862	36,166	1880	49,899
1825	12,637	1844	605,256	1863	53,243	1881	39,710
1826	5,167	1845	357,050	1864	49,129	1882	178,779
1827	9,944	1846	624,796	1865	161,937	1883	43,108
1828	9,729	1847	138,675	1866	46,806	1884	125,156
1829	13,602	1848	92,017	1867	32,859	1885	123,466
1830	9,003	1849	43,394	1868	17,329	1886	136,666
1831	13,490	1850	35,479	1869	17,249	1887	140,065
1832	5,466	1851	26,200	1870	26,315	1888	194,216
1833	7,695	1852	51,194	1871	79,880	1889	161,614
1834	3,029	1853	19,604	1872	48,132	1890	181,030
1835	3,174	1854	43,352				

* Fiscal years ending September 30th until 1842; fiscal years ending June 30th until 1885; and calendar years ending December 31st subsequently. † Nine months.

THE LEAD MARKET IN 1891.

Lead has not again been disturbed by such fluctuations in price during the past year as were experienced in the fall of 1890, which was a time when throughout the country, the greatest scarcity of the metal prevailed and heavy quantities had to be imported. Before arrival of the foreign material, however, prices in New York were driven up to the abnormal price of 5.80c., this point being reached in the beginning of November, 1890. A heavy reaction then set in and the present year opened with the figures at about 4.15c. to 4.20c. The outside figures during the present year were 4.05c. and 4.625c., New York, which, in itself is a rather wide margin and does not exactly express the state of actual business done, which is more correctly taken as having been done between 4c. and 4.4c. No undue speculation was experienced and prices shaped themselves according to demand and offerings. With the exception of a few thousand tons which were put in store in April and May, for speculative purposes, no actual accumulation of lead took place at any time during the year until toward the close, when some of the smelters kept back their product in anticipation of higher prices. Otherwise production and consumption each about held its own. So the larger quantity produced during the year may be said to have been entirely consumed, and the amounts remaining to be taken over into next year are hardly sufficient to provide for any contingency. Considering this the closing values would have to be spoken of as very low were it not that production evidently is still on the increase.

Again, during the present year, more ore has come in from Mexico, in consequence of a ruling by the customs authorities regarding the valuation of lead and silver ores, the former of which have now to pay a duty of 1c. per lb. on the lead contained, and the latter \$30 per ton of material. Ore is considered to be a silver ore when the value of the silver is greater than that of the lead, and while formerly the value of the lead was obtained by calculating it at 1c. per lb. below the official quotation in New York, it is now arrived at by taking the value at 1c. below such official price. This has permitted smelters to bring in considerable quantities in spite of the duty which has now to be paid on such ores.

It is much to be regretted that these ores cannot come in free of duty; the result of the increased tariff has been to injure the American smelting industry and the dry ore mining industry. Previous to 1890 only a few unimportant smelting works existed in Mexico, the product of which was very small; but when the American market was closed to the Mexican miners, who could not afford to pay the heavy freights to Europe on the low grade ores, nothing was left for them to do but to establish a smelting industry of their own. The opportunity was promptly seized, not alone by them, but also by some of the larger American smelters, who found themselves deprived of a portion of their supplies; they too went over to Mexico and started up smelting works, which are now partly in operation and

will be entirely so early next year. At present the production of lead bullion in Mexico goes on at the rate of about 1,200 tons per month, but very shortly this will be increased to about 2,500 tons, and may, by the end of next year, amount to 3,000 tons. If this latter figure is reached, it will mean that Mexico will then produce about one-sixth as much as the United States, and there can be no doubt that most of this bullion would have been produced here had not the law been altered in a most deplorably narrow minded spirit. The railroads have been heavy losers thereby, as have also the laborers, who would otherwise have received the money paid out in wages, and the dealers in supplies, etc.

In this country, supplies of raw material have been more plentiful as the end of the year approached than for a long time, and smelters finding themselves so abundantly supplied were able to somewhat raise their treatment charges, which had come down to quite dangerously low figures.

As already mentioned the market opened at the low figure of about 4.15c., but immediately showed very great strength, and prices quickly advanced by the middle of January to 4.50c. to 4.55c., and very soon 4.6c. was reached. This was due, principally, to the heavy demand in the West, and very often during the year it was noticeable that prices in St. Louis and Chicago were considerably above the parity of the Eastern markets. However, it was soon felt that the matter had been overdone, and the market became flat, prices going to about 4.30c. by the end of January. They continued to fluctuate between 4.45c. and 4.25c., which latter figure was reached in the middle of February, when a period of greater stability set in; until the end of March, with a fair business doing, prices ruled steady between 4.30c. and 4.40c. An attempt was then made to place prices on a higher level; 4.50c. was touched, but could not be maintained, and April found a flat tendency throughout, with prices declining by the end of the month to 4.4c., at which a considerable demand sprang up, and 4.25c. to 4.30c. was again reached, and maintained until the end of May. Consumption being very heavy at that time of the year, the legitimate demand gradually hardened prices, and at the beginning of June 4.50c. was the mark established, the market continuing very steady throughout that month at about that figure. There was then a little easier tendency, and in July the figures ranged between 4.40c. and 4.45c.

At the beginning of August some sales were made at 4.45c., but afterward 4.35c. was touched, when a serious strike took place at the Omaha works of the Omaha & Grant Smelting and Refining Company, and that establishment remained idle for some weeks. The threatened deficiency of course reacted on prices, which went up to the highest point of the year, viz., 4.6c. It soon became known, however, that the bullion was being diverted to neighboring works to be refined, and consequently the price declined to 4.40c. to 4.50c., at which it stayed throughout the second half of August and the month of September; in the latter month, however, a hardening tendency was observable, and 4.55c. to 4.60c. was again reached, and kept until the middle of October.

The approaching fall and the dullness in business generally made buyers very cautious, and some lead accumulated in the Western market. This opportunity was eagerly seized by some parties in New York, and an onslaught on prices commenced, and finding no opposition from any part, prices were forced down very quickly, until, by the middle of November they reached the low point of 4.05c. Much lead was not forthcoming, but in spite of that the market remained dull for some weeks, and would perhaps have done so longer, had not smelters bid up the market against themselves by refusing to make sales at those prices. At this point the quotation was advanced on one day 1/2c., and by the end of the month 4.35c. was reached, but only to very soon make room for 4.25c., which price ruled steadily through December.

The importations of foreign lead were very small, and only some odd lots were brought in, but from last year's imports there remained over some quantities, and there are still in bond in this city about 1,700 tons.

AVERAGE MONTHLY PRICES OF LEAD IN NEW YORK, IN CENTS PER POUND.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1870	6.25	6.21	6.15	6.20	6.22	6.22	6.25	6.35	6.33	6.31	6.30	6.30	6.25
1871	6.22	6.22	6.17	6.15	6.14	6.13	6.12	6.00	6.05	5.93	5.95	5.87	6.38
1872	5.95	5.93	5.93	6.00	6.43	6.50	6.50	6.45	6.40	6.51	6.55	6.51	6.30
1873	6.32	6.45	6.37	6.37	6.37	6.50	6.33	6.06	6.12	6.50	6.50	6.25	6.32
1874	5.95	6.12	6.18	6.07	5.87	5.81	5.71	5.72	5.87	6.22	6.37	6.26	6.01
1875	6.10	5.87	5.68	5.83	5.92	5.82	5.97	5.91	5.78	5.62	5.76	5.90	5.85
1876	5.93	6.17	6.45	6.26	6.10	6.37	6.27	6.32	6.12	5.90	5.75	5.67	6.13
1877	6.12	6.30	6.62	6.37	5.77	5.65	5.50	5.00	4.80	4.55	4.62	4.55	5.49
1878	4.17	3.75	3.75	3.62	3.37	3.30	3.43	3.35	3.35	3.48	3.77	3.95	3.61
1879	4.25	4.50	3.87	3.06	3.00	3.46	4.00	4.02	3.87	4.75	5.30	5.55	4.14
1880	5.80	5.93	5.92	5.57	4.82	4.62	4.50	4.65	4.85	4.76	4.80	4.50	5.04
1881	4.95	4.95	4.75	4.90	4.47	4.37	4.70	4.85	5.16	5.06	5.07	5.12	4.81
1882	5.05	5.10	5.00	4.95	4.72	4.72	5.02	5.02	5.05	5.00	4.70	4.62	4.91
1883	4.65	4.55	4.57	4.50	4.47	4.42	4.35	4.25	4.31	4.22	3.85	3.67	4.32
1884	4.12	3.90	4.12	3.84	3.63	3.61	3.62	3.61	3.65	3.67	3.46	3.62	3.74
1885	3.65	3.65	3.65	3.65	3.65	3.75	4.00	4.25	4.25	4.20	4.10	4.55	3.65
1886	4.5	4.75	4.90	4.78	4.70	4.75	4.87	4.75	4.65	4.22	4.35	4.32	4.63
1887	4.31	4.37	4.32	4.27	4.52	4.65	4.55	4.58	4.50	4.25	4.40	5.12	4.50
1888	4.9	4.9	5.15	4.75	4.75	3.9	3.97	4.45	5.00	4.50	3.67	3.75	4.42
1889	4.84	3.73	3.72	3.68	3.78	3.96	3.88	3.86	4.00	3.86	3.84	3.80	3.93
1890	3.86	3.85	3.95	4.05	4.20	4.42	4.62	4.60	5.11	5.87	5.02	4.24	4.48
1891	4.38	4.31	4.35	4.25	4.28	4.48	4.42	4.42	4.52	4.39	4.12	4.25	4.35

THE LONDON LEAD MARKET IN 1891.
(From our Special Correspondent.)

The New Year opened with a pause in the retrograde movement which had carried soft foreign from £14 15s. in October down to £12 17s. 6d. in the middle of December. English smelters seemed to take a rather gloomy view of things, fearing that consumption would be insufficient to easily absorb the rapidly growing shipments from Australia in addition to the old sources of supply. Moderate sales suffice to induce a decline to £12 12s. 6d., at which the month closed, while there were sellers at the commencement of February at £12 10s. Soon after which £12 8s. 9d. was reported as done, and the market wore a decidedly sluggish aspect. Consumption at home was, however, described as fairly good and stocks were not large, but the export trade was at a low ebb and furnished continuous and fruitful cause of complaint.

During March there was no important change to record, and values

ruled very steady at £12 10s. @ £12 8s. 9d., Spanish. The Australian shipments for this and the preceding month amounted in all to over 8,000 tons.

April was a month of quiet trade, both home and export, and values were again depressed, sales taking place at £12 7s. 6d. The tendency at the close was a shade firmer, and the next month opened with buyers at £12 10s. Spot foreign being scarce, partly in consequence of the sinking of a cargo of 600 tons Spanish, we then witnessed a temporary firmness, during which £12 12s. 6d. was paid for foreign and £12 15s. for English. Demand was, however, soon appeased, and we closed the month with sellers at £12 8s. 9d.

June brought with it a welcome change, lead, in common with other metals, improving substantially. Business in Spanish was reported at £12 15s., while the English people were so full with orders that they were scarcely able to undertake delivery before August. On the Tyne £13 was reported as paid. Toward the close of the month arrivals of Spanish lead and a cessation of manufacturing orders combined to put the value down to £12 10s., and July opened still lower, viz., at £12 6s. 3d. After rising to £12 11s. 3d. we declined again closely at £12 7s. 6d., with rather buyers over.

August was an exceedingly dull month. Sales were very difficult and there was also a little "bearing" to contend with. Under these influences the value dropped from £12 6s. 3d. to £12 1s. 3d. The early part of September was marked by a somewhat improved demand and a fair business in foreign at £12 5s. and £12 7s. 6d.

October opened without any essential alteration, but, export trade being almost a dead letter and the building strike in London affecting the home demand, we witnessed a considerable fall in price, the month closing with sellers, including English, at £12. The unfavorable conditions which characterized the previous month grew worse still in November, and, as the various lots coming forward had to be sold, the result was a drop to the lowest point of the year, viz., £11 11s. 3d. From this figure we rallied to £11 15s., which was paid for Spanish before the month closed. The building strike here had now been terminated, but this came too late to be of service to the market, as any effect of the same could scarcely be felt before the spring.

December opened dull, with very little disposition to operate on any side. English smelters are fairly well sold, but there is a dearth of fresh business. The tone of the market at the moment of closing our report is decidedly flat, and Spanish is reported as having been done at £11 10s., and even at £11 7s. 6d., while the frequent arrivals (as ballast in fruit ships) tend to further depress a market bare of orders. The final quotations are £11 5s. @ £11 7s. 6d. soft foreign and £11 12s. 6d. @ £11 15s. English.

The following are the Board of Trade returns for the eleven months, January to November.

	1891.	1890.	1889.
Imports.....	152,205	146,378	131,482
Exports.....	43,863	50,851	49,292

MANGANESE.

By R. A F. Penrose, Jr. Ph. D.

Production.—The production of manganese ore proper in the United States in 1891, independently of manganiferous iron ores, manganiferous silver ores and manganiferous zinc ores, has been probably less than 20,000 tons. The production for 1889 was 23,927 tons. The largest annual production in the United States was in 1887, when 34,524 tons were mined.

There have been three causes for the falling off of the manganese production in the past three years:

1. The output of Virginia, which for a number of years past has afforded considerably over half the American production of manganese ore, has decreased.
2. Imported ore from Chili, Cuba and Russia has competed successfully with the American product.
3. The dullness of the manganese market in the past year (1891) has discouraged energetic mining operations.

Most of the manganese ore of the United States is produced in the States of Virginia, Georgia and Arkansas, mentioned in the order of the quantity of ore produced; while smaller amounts are derived from Leadville, Colorado; San Joaquin County, California, and the Lake Superior region of Michigan. The old manganese workings at Brandon, Chittenden and South Wallingford, Vermont, were idle in 1891. The residuum from the manganiferous zinc ores of Sterling and Franklin, New Jersey, is used, after the extraction of the zinc, as a source of spiegeleisen.

Besides the manganese localities already mentioned, similar ore is found in many other states, especially Michigan, Pennsylvania, North and South Carolina, Tennessee, Alabama, Missouri, Texas and Nevada, but the total amount produced from these localities in past years has been very small, amounting altogether to not over a few thousand tons.

The total production of manganese ore in the United States from the time it was first mined over thirty years ago up to Dec. 31st, 1891, has been probably between 275,000 and 300,000 tons. The following statement of the production of manganese in the United States is taken from the report of the Eleventh Census:

PRODUCTION OF MANGANESE IN THE UNITED STATES (IN TONS OF 2,240 LBS.).

State.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.
Virginia.....	3,661	3,295	2,982	5,355	8,980	18,745	20,567	19,835	17,616	14,616
Arkansas.....	.....	100	175	400	800	1,483	3,316	5,651	4,312	2,528
Georgia.....	1,800	1,200	1,000	.....	.....	2,580	6,041	9,024	5,568	5,208
Other States.....	300	300	375	400	400	450	269	14	1,672	1,575
Total.....	5,761	4,895	4,532	6,155	10,180	23,258	30,193	34,524	29,198	23,927

Virginia.—The manganese mines of Virginia are mostly located in the Valley of Virginia—especially in Augusta, Rockbridge, Botetourt and other counties, with smaller developments in the valley of the James River. The Crimora mine, which for many years has been by far the largest producer in America, is in Augusta County, two miles east of the Shenandoah River. Several new developments have been made lately in the same region as well as higher up the valley, but nothing has as yet been discovered that equals this famous mine. Probably over 150,000 tons of manganese ore have been mined in Virginia from the time mining was

first begun up to Dec. 31st, 1891. The Crimora mine has produced over four-fifths of this total amount.

Georgia.—The manganese mines of Georgia are mostly in Bartow County, in the northwest part of the State, though smaller developments were formerly made in Polk, Floyd, Whitfield and other counties. The mines of the latter region are now idle and Bartow County practically supplies the Georgia production.

The manganese production of Georgia in 1891 was between 5,000 and 6,000 tons. The total production of the State from the time manganese mining was first begun in 1866 up to December 31st, 1891, has probably been over 60,000 tons.

Arkansas.—The manganese mines of Arkansas are in Independence and Izard counties—known as the Batesville region—in the northern part of the State. The only ore of importance produced in 1891 came from Independence County. Here the production in 1891 was narrowed down mostly to one locality, the Southern mine, which is the property of the Keystone Manganese and Iron Company of Pennsylvania.

The total production of the Batesville region in 1891 was about 1,500 tons. The production in 1890 was between 3,500 and 4,000 tons. This decrease in output was due to the dullness of the manganese market during 1891. No ore was produced in 1891 from the manganese deposits of southern Arkansas. The total production of manganese in Arkansas from the time mining was first begun up to December 31st, 1891, was a little short of 35,000 tons.

Colorado.—In the Leadville region of Colorado several thousand tons of manganese and manganiferous iron ore have been produced in the past two years, and shipped mostly to the Colorado Coal and Iron Company, at Pueblo, Colorado, with smaller quantities to the Illinois Steel Company at Chicago. The ore is derived mostly from the upper workings of the silver deposits and represents the oxidized outcrops of sulphuret ores below. Most of this ore was shipped by Mr. Chas. P. Schumacher from the Crescent and Catalpa mines, while smaller quantities were shipped by Mr. Franklin Ballou. The amount of this ore shipped from Leadville is more or less dependent on the work on the silver ores, as it is often a by-product in the mining of the latter. It is only shipped to the steel makers when too low in silver to be available as a source of that metal.

California.—In California manganese is mined at present in but one place, Corral Hollow, San Joaquin County. Even here only a few hundred tons at the most are produced annually. The total production of the mine since it was first opened in 1867 has probably not exceeded 8,000 tons and of this amount 5,000 tons were produced between 1867 and 1874. The total production of California since mining was first begun in 1867 has probably not exceeded 10,000 tons.

Methods of Mining.—The largest manganese deposits in the United States—those of Virginia, Georgia and Arkansas—occur as irregular nodules, layers and pockets in clay. They are usually worked by shafting and drifting, and the loose character of the ground frequently necessitates expensive timbering. In some cases large open cuts have been worked successfully. In Colorado and California the deposits occur in solid rock and the ore is obtained by the ordinary process of mining. The ore in the clay is usually washed before shipment in an ordinary iron-ore washer, as in Virginia and Arkansas, or in revolving perforated cylinders as in Georgia. The smaller ore is also sometimes cleaned by jigging.

American Uses of Manganese.—Over nine-tenths of the manganese production of the United States is consumed in the manufacture of ferromanganese and spiegeleisen for use in steel making. The rest, usually the higher grades from Virginia and some from Georgia, is consumed in the manufacture of bromine, in clarifying glass, in making manganese bronze, silver bronze and other alloys, besides in small quantities for numerous other manufacturing and chemical purposes.

Manganiferous Iron, Silver and Zinc Ores.—Besides the ores valuable primarily for their contents of manganese, the United States produces annually large quantities of manganiferous iron ores, manganiferous silver ores and manganiferous zinc ores. These are simply iron, silver and zinc ores, respectively, containing greater or less quantities of manganese. The manganese in them, though often of service, is of less importance than their other constituents, and the discussion of such ores, therefore, comes more properly under the headings of iron ores, silver ores and zinc ores.

The most important area of manganiferous iron ores in the United States is the Lake Superior region of Michigan and Wisconsin, especially the Gogebic Range, while smaller quantities occur in Vermont, New Jersey, Pennsylvania, Virginia, Tennessee, North Carolina, Georgia, Alabama, Missouri and other states.

Manganiferous silver ores are usually more valuable for their silver contents than for their manganese, and as they cannot be used as sources of both metals the more profitable use of course prevails. The presence of the manganese, however, lends an additional value to the ore on account of its fluxing qualities. The principal regions of manganiferous silver ores in the United States are Leadville, Colo., Butte City, Mont., and Tombstone, Ariz.

Manganiferous zinc ores are mined at Sterling and Franklin, N. J. They are used both as a source of zinc and of manganese. The zinc is first removed and then the residue, known as "clinker," is used as an ore of manganese in the manufacture of spiegeleisen.

MICA.

Occurrence.—The localities in the United States in which mica occurs in an available form are not very numerous, and it is only in New Hampshire and North Carolina that the industry has assumed much importance. In the West the most important deposits are located in the Black Hills, in the neighborhood of Hartsville, Wyo., and in the Cribbensville district of New Mexico, but these have not been worked in 1891 except in a desultory manner and have produced no material of consequence. The available deposits of mica occur in bands of coarsely crystalline granite. In these bands the three constituents of the granite (mica, feldspar and quartz) have in a measure crystallized in separate masses, and the mica is found in bunches or pockets irregularly distributed throughout the mass.

Preparation.—Mica is used in two forms, sheet mica and ground mica, and the manner in which it is treated when taken from the mine depends upon the form in which it is to be used. If it is to be sold as scrap for grinding, all that is necessary is to remove the adhering fragments of quartz and feldspar and such parts of the mica as may contain foreign ingredients. If it is to be used in the sheet form the process is much more complicated, the blocks being first split into sheets thin enough to cut easily, then marked with a pattern of the size desired, cut along the lines marked, and the different sizes wrapped in paper and packed for shipment. There is a great amount of waste about this operation. The amount of sheet mica obtained does not usually exceed from four per cent. to eight per cent. of the block mica treated.

Uses.—The most common and well known use for mica is in the paneling of stove and furnace doors. For this purpose the mica must be clear, free from spots, and of a uniform color throughout the sheet. The most desirable color is a wine red, and next to this comes white mica, which is nearly as valuable. Another important use is in the manufacture of electrical apparatus, for which purpose its non-conducting properties render it valuable. The qualities required for this use are firmness of texture, toughness and ready cleavage, and freedom from iron in its composition.

There is a greater range of use for ground mica than for the mineral in sheets, and, though the value of that part of the product made use of in this form is small, the many peculiar properties which ground mica possesses render it quite probable that its use will be widely extended. The difficulties to be overcome in grinding mica are considerable, and there are only two or three firms engaged in the business at present. Eight standard grades of ground mica are made. The coarsest of these are used to give frosted and spangled effects to the fancy grades of wall paper. The medium grades are employed in the manufacture of a lubricant for the journals of railway carriages, for heavy bearings generally, and for the axles of road vehicles. The finest grades are used in producing a uniform metallic white surface on wall paper. Scrap mica for grinding must be white and as free from specks or colored matter as possible, since any impurities in the scrap will affect the color and luster of the product.

Production. The production of mica in the United States for the past ten years and the value of the imports into the country are shown in the following tables:

Year.	Amount, lbs.	Value.	Year.	Amount, lbs.	Value.
1880.....	81,669	\$127,825	1885.....	92,000	\$161,000
1881.....	100,000	25,000	1886.....	40,000	7,000
1882.....	100,000	250,000	1887.....	70,000	142,250
1883.....	114,000	285,000	1888.....	48,000	70,000
1884.....	147,410	368,525	1889.....	49,500	50,000

The value of the product in 1890 was \$32,569.

Year.	Value.	Year.	Value.	Year.	Value.
1869.....	\$1,165	1875.....	\$350	1881.....	\$5,339
1870.....	226	1876.....	1,821	1882.....	5,175
1871.....	1,460	1877.....	13,085	1883.....	9,884
1872.....	1,002	1878.....	7,930	1884.....	28,284
1873.....	498	1879.....	9,274	1885.....	28,685
1874.....	1,204	1880.....	12,562	1886.....	56,354

* Fiscal years.

No statistics of the production of mica in the United States in 1891 are at present available. It is probable, however, that the output has not been materially different from that of the last few years. Practically the entire amount has come from the mines of North Carolina and New Hampshire. The imported mica comes chiefly from India and Canada. The mica market has been devoid of unusual features during the year. There has been a considerable increase in consumption on the part of the manufacturers of electrical machinery and a natural increase in the consumption for stove purposes. There has been rather a scarcity of higher grade micas used for the latter purpose and prices have been somewhat higher in consequence. The lower grade micas used by the electrical manufacturers have been in abundant supply. The value of mica at present ranges between 10c. and \$5 per lb. With this wide range, prices depending entirely upon the grade of the article, it is next to impossible to make close comparisons.

MINERAL PAINTS.

By Prof. J. F. Kemp, School of Mines, Columbia College, New York.

Mineral paints may be divided into two classes, those produced from metallic minerals or ores, and those from non-metallic or earthy minerals. The former are chiefly the ores of iron, limonite (called also brown hematite and bog ore) red hematite, and the mixtures of limonite and clay known as ochres, but in which the ore gives the color. With these are also classified white lead, red lead, and zinc white. The non-metallic paints include barite, slate refuse, slag-graphite, ultramarine, etc.

Limonite and Ochre.—The long succession of Siluro-Cambrian limonites on the New York and New England border and southward in the great valley has afforded suitable material for paint in a number of localities. Works were early established at Brandon, Vt., and still remain in somewhat desultory operation. The ore is dug and dried in small sheds much as are bricks, and then ground. It affords in the crude state yellow or yellowish brown colors, but when roasted gives varying shades of red and darker brown. Small developments have also been made near Hoosick Falls, N. Y. All these limonites are mixed with more or less ochreous clay that goes to waste when the ore is mixed with iron. The locality most productive of paint from what may be called an iron ore is in the southern part of Carbon County, Pa. A bed of a bluish rock that affords on analysis 29% to 35% metallic iron and varying amounts of silica, alumina, lime and magnesia is found just over the Oriskany sandstone. The iron is probably present as carbonate. The ore or rock is hand-picked to rid it of slate and then roasted and ground, and affords a rich, dark, reddish-brown pigment.

Ochre is a name distinctively applied to soft clay-like or powdery material not possessing the solidity of limonite proper but being essentially a very impure iron ore. This occurs in many places and is of itself a valuable product in Pennsylvania, Georgia, Virginia and Maryland. The deposit at Bermuda Hundred, Va., affords an excellent grade, and numerous others occur with the Siluro-Cambrian limonites referred

to above. Large amounts are also imported, especially from France, Italy and England. The tests of a good ochre are the depth and strength of color afforded by the paint and the amount of oil required in grinding; the less oil, the more valuable the ochre, other things being equal. Umber is essentially an ochre of a brown color, containing oxide of manganese, that gives it its peculiar tint. The best grades, and, in fact, nearly all the supply, come from Italy. Sienna is another variety of this ferruginous clay, with a different color.

Red Hematite.—Within the last few years red hematite iron ore has been growing in favor as a pigment, and is now ground in large quantities in various parts of the country. The chief source of the mineral is the Clinton ore, or, as it is called in different sections, fossil ore, dyestone ore, oolitic ore, flaxseed ore, etc. This forms a series of beds in shales of the Clinton stage of the Upper Silurian, and is doubtless the most extended and persistent iron ore deposit in the world. It outcrops in Wisconsin, Ohio, New York and down the Appalachians to Alabama. It is utilized for paint at Clinton, N. Y., where about 10 tons are ground daily, and is employed in the same way in the South.

White Lead.—This, the most important of the white pigments, is a carbonate of lead, and is made artificially from the pig metal. The lead is cast in flat perforated plates, 7 in. in diameter and $\frac{1}{4}$ ins. thick. These are placed in earthen pots, and then a dilute solution of acetic acid is poured over them. They are then stacked together, and covered with spent tan bark or manure, and are left about 30 days. In this time the lead becomes in large part corroded and converted into the carbonate, to the extent of 60% or 70%. The product is then washed away from the uncorroded metal, settled and shipped. A white sulphate of lead is made directly from galena in a reverberatory furnace in Joplin, Mo. The white lead industry is now controlled by a combination of manufacturers. A considerable though decreasing amount is imported. Barytes is used to some extent as an adulterant.

Zinc White.—Zinc white is second only to white lead as a white pigment and is very extensively employed. It is made in great quantities in New Jersey and Eastern Pennsylvania from the zinc and manganese ores of Franklin Furnace and Ogdensburg, N. J., and from zinc ores brought from various quarters. Also in the Mississippi Valley and in Southwest Missouri it is manufactured from blende. The process consists in volatilizing and oxidizing the zinc directly from the ore. As compared with white lead, zinc white has a yellowish cast.

During the past year the American Zinc-Lead Company has engaged in the manufacture of zinc-lead paints at Cañon City, Colo., by the process invented by Mr. F. L. Bartlett. In this, complex sulphide ores are burned in a special furnace or kiln, the zinc and lead being volatilized and the fumes condensed as zinc and lead oxides. No method of separating these oxides has yet been devised and the mixture is sold as a pigment. The iron of the ore, with most of its silver contents, remains in the furnace or kiln and is sold to the lead smelters.

Red Lead.—Red lead, or minium Pb_3O_4 , furnishes a useful red pigment and is also somewhat used in glass making. It is obtained by oxidizing metallic lead. The American market is chiefly supplied by the home product, although small amounts are imported.

Barite.—Barite (barytes), or heavy spar, is the natural sulphate of barium. It is a dense white mineral easily scratched with a knife and of the extraordinarily high specific gravity, 4.5. If powdered, moistened with hydrochloric acid and ignited with repeated moistenings on a platinum wire in the blue flame of an alcohol lamp or Bunsen burner, it gives the flame a peculiar green hue that is its infallible test. Lack of effervescence with acid distinguishes it from the rarer barium carbonate, witherite. Barite is a frequent gangue in mineral veins and is frequently found in connection with galena and zinc blende. It also occurs as a vein-filling and as pockets in many limestone districts, and deposits of this nature are its chief commercial source. It reaches the market from two principal districts, the largest being in southwest Virginia and North Carolina, the other in eastern Missouri. Smaller amounts come also from Illinois. The mining is in general somewhat irregular and is carried on, especially in Missouri, by farmers in off-times. The mineral is there known as "tiff." Barytes of the best grade should be free from impurities, especially quartz and iron stains. The former injures the mills in grinding, as it is so much harder than the barite, while the latter injures the color of the paint. In preparation the barytes is crushed to the size of buckshot and then boiled in sulphuric acid to remove the iron rust. It is then boiled in distilled water to remove the acid and iron salts, dried and ground. It is next sorted by "floating in water," as it is called. The coarser portion settles quickly, while the very finest which gives the best grade of pigment remains longest in suspension. It is finally dried by steam, barreled and shipped. The principal use is as a pigment. Its great specific gravity enables it to remain in suspension and thorough mixture when ground with white lead. As barytes is worth from 1 to 1½c. a pound and the value of white lead is 6 or 7c., it is a tempting adulterant. It can hardly be said to injure the pigment, the objection being that the purchaser pays for one thing and gets another. For some purposes it has its own decided advantages as a paint, in that sulphurous gases do not discolor it. Considerable amounts are imported from Germany. Crude barytes is worth about \$5 per ton, spot value.

Slate.—Within the last few years the refuse of slate quarries has been ground as paint, and even poor grades have been somewhat utilized for the same purpose. A quarry at Grafton, near Troy, N. Y., produces a considerable quantity. It makes a useful "filler" or first coat for other colors. Somewhat more than 2,000 tons are annually manufactured.

Slag.—Puddle slag and heating cinder have been recently utilized at Boonton, N. J., for paint. The process involves crushing the slag to an impalpable powder with a Cyclone pulverizer, and then settling it with some sorting action in air chambers. Used directly and alone, it affords a dark olive green paint, which also makes an excellent body for other and brighter shades. In making reds, the coarser crushed material from the first treatment is mixed with sulphuric acid and allowed to sweat, as it is called, for four days. This changes the slag from silicate to sulphate of iron. It is then calcined to afford the oxide and reground. The reds familiar on cars of the New York Central and Erie railroads are thus afforded. The mill is making five to six tons of paint stock daily. The process promises to be useful wherever these slags are available. It is patented.

Graphite.—Graphite has been finding some application as a pigment in recent years, and it is one of the most important uses to which this valuable substance can be put. It is ground with oil and especially employed for metallic surfaces. For this purpose inferior grades can be utilized which would be ill adapted to lubricating the manufacture of pencils, etc.

Ultramarine.—Ultramarine was originally made from the rare mineral lapis lazuli. The latter is found in Persia and elsewhere in the interior of Asia, but when ground for the finest grades of the pigment it must be so choice that the latter costs at times more than \$100 an ounce. Lapis lazuli is a complicated compound, being a silicate of soda, lime and alumina, with sulphides of iron and sodium also entering into its composition. The manufacture of ultramarine is based on an attempt to imitate this natural compound. Hence china clay, sodium sulphate, charcoal and resin (or some similar mixture) are ground together and calcined in muffles for 12 to 36 hours. They are then slowly cooled during 5 or 6 days. The manufacturers in this country are located at Whitestone, L. I., and Newark, N. J., and the output for 1889 was about 2,781,000 lbs., worth rather less than 10 cents per pound. Somewhat more than half a million pounds are imported annually.

NICKEL.

By W. B. Ingalls, M. E.

The principal ores of nickel are the hydrous silicate of nickel and magnesia (garnierite), nickeliferous pyrrhotite and chalcopyrite, nickel sulphide and nickel arsenide, the latter two usually being associated with cobalt minerals.

Physical Characteristics.—Garnierite is a brittle mineral of apple-green color and glinting to dull lustre; its streak is pale-green and its hardness 2.5. Before the blowpipe it gives the characteristic nickel bead when fused with borax, *i. e.*, violet when hot and red-brown to brown when cold. Heated in the closed tube it gives off water. Millerite, or nickel sulphide, is a brass-yellow mineral, often with a gray, iridescent tarnish. Its streak is bright; hardness, 3-3.5; specific gravity, 4.6-5.65. Before the blowpipe, on charcoal, it fuses to a globule, and after roasting gives with borax a violet bead in the oxidizing flame, which becomes gray from reduced nickel in the reducing flame.

Occurrence.—The ores of nickel are widely distributed, but it is in comparatively few localities that they exist in workable quantities. The most important sources of the metal at the present time are the mines of New Caledonia, where there are vast deposits of garnierite, and the nickeliferous pyrrhotite and chalcopyrite mines of Sudbury, Ont. Nickel ores are also mined in Norway, Sweden and Germany and in smaller quantities in several other countries of Europe. In the United States there is but one deposit of nickel which has been mined regularly for that metal alone, it being located at Lancaster Gap, Penn. The lead ores of Southeastern Missouri carry a small amount of nickel, in conjunction with cobalt, both of which are recovered as by-products. Other deposits of nickel are known to exist in Churchill County, Nev.; at Riddles, in Oregon; at Benton, Ark.; Chatham, Conn.; Webster, N. C.; in Fremont County, Colo.; and in the Black Hills, S. Dak.; but none of these mines have yet become regular producers, although the two first mentioned, which are considered the most promising, have been developed to some extent and have turned out a small amount of ore. The ore at Riddles is nickel silicate, and that of Nevada, cobalt and nickel sulphide. During the past year nickel ore is reported to also have been discovered at Hope, Kootenai County, Idaho, and at Asheville, N. C.; the former has not yet been verified, however, and the latter proved upon investigation to be of too low grade to be worked profitably.

Reduction.—The production of nickel in the United States was considerably smaller in 1891 than in the previous year, owing to the falling off in the output of the famous old Lancaster Gap mine, which was idle for three months of the year. This mine, as is well known, is rapidly approaching exhaustion, and in the future it may be expected to show a constantly diminishing output. Its product in 1891, however, as in previous years, represents, practically, the entire product of nickel in the United States. The St. Joseph Lead Company, of Bonne Terre, Mo., and the Mine La Motte, of St. Francois County, Mo., made their usual output of nickel and cobalt, but the amount is trifling. The ore of these mines is galena in a gangue of magnesian limestone, with which is associated some iron pyrites carrying a small percentage of nickel and cobalt, and this pyrites is saved as a by-product, being shipped to the American Nickel Works, at Camden, N. J., for reduction.

No work of any consequence was done at the Oregon mines during the year, but some exploration work was done in the Nevada mines. The latter are located at the junction of Bolivia and Cottonwood cañons, in Churchill County, about 41 miles east of Lovelock's Station. One of these mines, the London, is owned by the National Nickel Mining Company, of New York and London, which has been working a force of 10 men for the past 12 months and has produced some nickel ore. A small lot of selected ore, perhaps 40 tons, was shipped to England for a test; this is not included in our statement of the production of nickel in the United States in 1891.

The production of nickel in the United States from 1876 to 1891, both years inclusive, together with the imports into the country and the exports from it, are given in the following table:

PRODUCTION OF NICKEL IN THE UNITED STATES; ALSO, IMPORTS AND EXPORTS.			
Year.	Production.		Value of Exports.
	Amount, lbs.	Av. Price.	
1876	201,367	\$2.60	\$523,554
1877	188,211	1.60	301,138
1878	150,890	1.10	165,979
1879	145,120	1.12	162,534
1880	233,893	1.10	257,282
1881	265,668	1.10	292,235
1882	231,616	1.10	309,777
1883	58,800	.90	52,920
1884	64,550	.75	48,412
1885	245,504	.69	169,398
1886	182,345	.60	109,407
1887	183,125	.64	117,200
1888	190,637	.60	114,382
1889	200,000	.62	125,000
1890	200,332	.65	130,216
1891	144,841	.60	86,905
			Value of Imports.
			\$10
			203,150
			8,200
			2,452
			13,399
			66,069
			122,130
			39,480
			143,660
			19,674
			22,083
			22,249
			11,723
			14,546
			51,333
			46,709
			39,576
			100
			471

The exports of nickel from New Caledonia in 1890, according to a recent consular report, amounted to 3,300 lbs., and of nickel ore to about 5,000 metric tons, which, averaging about 8% nickel, was equivalent to about 882,000 lbs. of metallic nickel, representing a total export of 885,300 lbs. The production of nickel (in nickel-copper matte) in Canada in 1890 was 1,336,627 lbs.; that being the first year for which statistics of the Sudbury district were published. The last official statistics of the mining industry of Norway, those of 1889, give the production of nickel in that country as 149,872 lbs.; the output in the preceding year was 145,464 lbs., and that of 1890 was probably about the same. The product of Sweden in 1890 was but 17,632 lbs., which was a great falling off from the preceding year.

Methods of Nickel Winning.—The nickeliferous chalcopyrite and pyrrhotite of Sudbury are first roasted and then smelted in cupola furnaces to nickel-copper matte, containing about 20% nickel. These mattes are very refractory and it is only within the past year that they have been successfully handled. Of the large output in the Sudbury district in 1890 but a comparatively small portion was shipped. About 15 months ago the Orford Copper Company devised a successful method for refining these mattes, and since then the bulk of the output of the Canadian mines has been brought to this country, the Orford Copper Company now being the largest nickel refiner in the world. Early in the year the United States Government purchased a large amount of matte of the Canadian companies, practically cleaning out their accumulated stocks, and all of this has been refined by the Orford Company. By the process used by the latter, which is a secret one, the copper and nickel in the matte are separated and the nickel converted into nickel oxide, which is said to be more suitable for the manufacture of nickel-steel than metallic nickel. A small part of the Sudbury mattes is sent to Swansea to be refined.

Nickel matte, or regulus, is usually refined by a wet process. The matte having been roasted is treated repeatedly with hydrochloric or dilute sulphuric acid, which dissolve the nickel and copper, and in the case of complex ores, the cobalt, lead and bismuth, if these metals are present. Any iron that may have gone into solution is precipitated by lime, having previously been converted into ferric oxide by the addition of chloride of lime. The temperature of the solution is then raised to 70° C., and the copper precipitated by calcium carbonate, milk of lime, or a solution of soda. When all the copper has been thrown down, the cobalt is precipitated by the careful addition of a solution of calcium chloride to the perfectly neutral, hot, and not too dilute filtrate. The nickel is finally precipitated as hydrate by calcium carbonate, milk of lime or soda. The nickel hydrate is filtered off, dried, heated with sodium carbonate to decompose any calcium sulphate that may be present, washed with acidulated water, dried again and finally reduced by carbonaceous materials to the metallic state. This process, being dependent upon the fractional precipitation of the several metals in the ore with the same reagents, is subject to slight alterations of procedure in various works.

Mr. Ludwig Mond, F. R. S., announced to the members of the British Association, at the Cardiff meeting, August, 1891, a new process of nickel winning, which is radically different from any now in use, and although not yet introduced upon an industrial scale, seems likely to be of importance. About a year and a half ago Mr. Mond, in conjunction with Dr. Carl Langer and Dr. Friedrich Quincke, discovered that a volatile compound of nickel and carbon monoxide, corresponding to the formula Ni(CO)₄, was produced when finely divided metallic nickel, such as that obtained by reducing nickel oxide in a current of hydrogen, was subjected at a moderate temperature to the action of carbonic monoxide gas, and subsequently allowed to cool. Upon being heated to a temperature of 200° C. the compound decomposes into its original constituents, and the metallic element is deposited in a bright, coherent mass of high degree of purity. Mr. Mond has made use of the properties of this new compound for the extraction of nickel from its ores, and has patented a process for this purpose. He proposes to calcine the nickel-bearing ore and reduce its oxide in a current of water gas. The reduced ore is then allowed to cool and is treated with carbonic monoxide in a closed vessel. The nickel carbonic oxide, which is thus formed, being volatile, is carried to another closed vessel, where it is heated and decomposed, the nickel being deposited upon thin nickel sheets, which are removed from time to time. As carbonic monoxide is extremely poisonous, all the operations are performed in closed chambers.

Mr. Mond also proposes to apply his discovery to nickel plating. The nickel deposited by the decomposition of nickel carbon monoxide is distributed over the surface of any solid in the neighborhood in a dense and coherent layer resembling and in every respect, it is claimed, equal to a coating of nickel deposited from solution by the electric current. It is thus possible to produce nickel plated ware with nickel obtained directly from its ore. Mr. Mond's paper describing these new processes was reprinted in full in the ENGINEERING AND MINING JOURNAL of Sept. 26, 1891.

There are three nickel smelting and refining works in the United States, viz., the American Nickel Works at Camden, N. J., the works of the Orford Copper Company at Constable's Hook, N. J., and the works of the Canadian Copper Company, near Cleveland, O., which are not yet completed. The American Nickel Works run on ore from the Lancaster Gap mine, Canadian mattes, and ore from Southeastern Missouri. The Orford works run exclusively on Canadian mattes. The Cleveland works are to run on mattes from the Canadian Copper Company's mines at Sudbury, Ont. In Europe the *Société du Nickel*, which owns the New Caledonia mines, has four refineries in operation, one near Havre, in France; one at Eislerlohn, Germany; one at Glasgow, Scotland, and the fourth at Irthington, near Birmingham, England.

THE NICKEL MARKET IN 1891.

The nickel market is peculiar in that the largest consumers customarily purchase from six months to a year ahead, contracts being quite generally made at the beginning of the year, prices varying with quantities and delivery. The principal supply being thus absorbed, the price of spot nickel is subject to considerable fluctuation, according to stocks and changes in demand, the price frequently rising far above the contract price of the year.

During the past year the consumption of nickel has undergone a large increase, due principally to the growing demand for the metal for use in

the manufacture of nickel-steel, the Creusot works, in France, alone having contracted for a large part of the product of the *Société du Nickel*, while the United States Government purchased the great quantity of 6,500 tons of Canadian matte, containing probably about 20% nickel. There has also been a natural increase in demand from the nickel-platers, the German silver manufacturers and other consumers. At the present time, moreover, the prospects seem to be that the consumption of nickel will further increase in 1892. During the past autumn the United States Government made elaborate tests of nickel steel and other kinds of armor plate at Indian Head, Md., which resulted in a decisive victory for the nickel-steel, and this has now been adopted as the protective material for the new cruisers and battle-ships. The use of other nickel alloys is constantly growing and a steady expansion in demand may be expected from this source.

The large contracts for nickel were made early in 1891 at a price in the vicinity of 60c., and sellers practically withdrew from the market. The demand for spot nickel began to improve in the first months of spring, and in April small lots were sold at 67½c. to 70c., but stocks in this country were small and no round lots were obtainable even at those figures. In June the demand became more active, and stocks remaining small, the price rose to 70c. to 75c. The metal continued scarce and the demand larger than the available supply during the next four months, when November and December shipments from Europe were offered at 63c. to 65c., and considerable quantities were contracted for. Still, holders were not anxious to sell at those figures, and rather held back. At the close of the year the situation remained unchanged.

PETROLEUM.

The production of petroleum in the United States in 1890 was 45,000,000 bbls., valued at \$35,000,000, against 35,163,513 bbls., valued at \$26,963,340 in 1889. The production in 1891 has again shown a great increase, due in considerable part to the phenomenal McDonald field of Pennsylvania. The average daily runs of the Pennsylvania, New York, Eastern Ohio and Northern West Virginia fields have been as follows: January, 90,673 bbls.; February, 84,316; March, 79,346; April, 84,320; May, 78,821; June, 81,946; July, 79,927; August, 86,101; September, 97,981; October, 117,855; and November, 128,444. In December the production of the McDonald field showed a falling off, but the total output of the Pennsylvania, New York, Eastern Ohio, and Northern West Virginia region in 1891 has probably been very close to 34,250,000 bbls. The total production of petroleum in the United States from 1859 and the exports from the country are shown in the following tables.

PRODUCTION OF CRUDE PETROLEUM IN THE UNITED STATES FROM 1859 TO 1874. [Barrels of 42 gallons.]

Years.	Total.	Years.	Total.	Years.	Total.	Years.	Total.
1859.....	2,000	1863.....	2,611,309	1867.....	3,347,300	1871.....	5,295,234
1860.....	500,000	1864.....	2,116,109	1868.....	3,646,117	1872.....	6,293,194
1861.....	2,113,009	1865.....	2,497,700	1869.....	4,215,000	1873.....	9,833,786
1862.....	3,056,690	1866.....	3,597,700	1870.....	5,260,745	1874.....	10,926,645

PRODUCT OF CRUDE PETROLEUM IN THE UNITED STATES FROM 1874 TO 1889. [Barrels of 42 gallons.]

Years.	Total.	Pa. & N.Y.	Ohio.	W. Va.	Colo.	Cal.	Ky. & Tenn.
1875.....	12,162,514	8,787,514	5,200,000	53,000,000	.....	6175,000	.....
1876.....	9,132,669	8,968,906	31,763	120,000	.....	12,000	.....
1877.....	13,350,363	13,135,475	29,888	172,000	.....	13,000	.....
1878.....	15,396,868	15,163,462	38,179	180,000	.....	15,227	.....
1879.....	19,914,146	19,685,176	29,112	180,000	.....	19,858	.....
1880.....	26,286,123	26,027,631	38,940	179,000	.....	40,552	.....
1881.....	27,661,238	27,376,589	33,867	151,000	.....	99,862	.....
1882.....	30,510,830	30,053,500	39,761	128,000	.....	128,636	c160,933
1883.....	23,449,633	23,128,389	47,632	126,000	.....	142,857	4,755
1884.....	24,218,438	23,772,209	90,021	90,000	.....	262,000	4,143
1885.....	21,847,305	20,776,041	650,000	91,000	.....	325,000	5,164
1886.....	28,064,841	25,798,000	1,789,970	102,000	.....	377,145	4,726
1887.....	28,278,866	22,353,193	5,018,015	145,000	76,295	678,572	4,791
1888.....	27,607,025	16,484,668	10,010,868	119,448	297,612	690,333	5,096
1889 (a).....	34,820,366	21,486,403	12,471,965	358,269	316,476	147,027	5,400

a. Included in the total are the outputs of Indiana, Illinois, Kansas and Texas, which commenced to produce in 1889. b. Including all production prior to 1875. c. Including all the petroleum produced in Kentucky and Tennessee prior to 1882.

EXPORTS OF PETROLEUM AND PETROLEUM PRODUCTS FROM THE UNITED STATES. [In gallons.]

Years.	Crude.	Naphtha.	Illumi-nating.	Lubri-cating.	Resid-uum.	Total.	Value.
1888.....	77,387,796	13,466,234	451,964,143	24,280,826	1,861,104	568,960,103	\$47,649,345
1889.....	83,991,196	13,958,880	548,395,731	27,754,239	1,838,694	675,938,540	52,793,241
1890.....	95,365,765	12,406,586	547,542,569	31,886,146	1,828,900	689,009,969	51,656,677
1891*.....	83,384,325	9,530,872	481,759,911	29,591,261	917,236	605,183,605	41,474,135

* 11 months.

REVIEW OF THE PETROLEUM MARKET IN 1891.

Specially reported by Messrs. Watson & Gibson.

Deliveries by the pipe lines in 1890 exceeded the receipts (runs) by nearly a million and a half barrels; we enter the year 1892 with an increased stock of over 5,000,000. The most important influences in the petroleum world this year have been increasing competition of Russia, increasing production in Pennsylvania, and an increasing use of Ohio oil. A year ago petroleum was above 70 cents and now it is below 60 cents. There was then a little market for Ohio crude oil at about 19 cents; it has since sold as low as 9½ cents on the exchanges, and now barely commands 14 cents. The price of this oil in the field is 35 cents. That is the price paid for it to the producer, but the holder of a certificate of the

Buckeye Transit Company (the Ohio branch of the National Transit Company) has to pay to this storage and transportation company 20 cents per barrel for delivery at a shipping station ready for transportation. The Standard Oil Company during the entire year has discouraged speculation in this product, but it no longer denies its ability to refine it. The policy of the Standard of late years has changed. It used to leave the ownership of wells in Pennsylvania to producers, but it has bought up or leased all the territory it could get its hands on in Ohio. The possession of that field is one of the most important points in favor of the permanent value of Standard Oil Trust stock.

A year ago there was talk among petroleum producers of a new shutdown movement, but such is always a hard undertaking. Each producer is willing to see others join it, but he himself would like to be free. In the past year another movement in the interest of producers proved to be abortive, this being the legislative attempt in Pennsylvania last winter to secure a reduction of pipe line and storage charges. Experience shows that the Standard is always able to resist any adverse legislation.

Last March oil was run up to 80 cents, but there was nothing new in the situation to account for the advance; on the contrary, it was palpable manipulation. The average daily production for February was 73,237 barrels, while the deliveries (consumption) were 65,160 barrels. The exports for February were about the same as for the same month in 1890. In January, February and March the visible supply of oil increased. When spring opened producers began to prospect freely for new wells and territory, and the result was shown in an immense output in the following autumn. In April the gross amount of fluid was 9,004,939 barrels, or 500,000 barrels greater than in March. At that time (April) the gross amount of Ohio oil in the custody of the Buckeye Company was 23,309,000 barrels, an increase of 532,000 from March. The total amount of Pennsylvania oil at the end of April, 1891, was 10,214,337 barrels, against 8,800,511 for the corresponding period in 1890.

During the early summer the American trade received a report from Consul Chambers at Batoum, which showed that the Russian production for 1890 averaged 80,000 barrels daily, against 68,000 in 1889. The consul reported that the export of Russian oil in 1890 was greatly obstructed by the low prices of American oil in foreign countries and changes in Russian currency. In May the receipts of the Pennsylvania oil were 2,405,000, against deliveries of 2,023,000 barrels, prices then hanging around 68 cents. During the summer the Standard made arrangements in Germany to cheapen the handling of oil, and its action excited perturbation in the minds of dealers there, who thought they saw signs of a new monopoly. The Standard really was seeking to beat Russian oil on Teutonic ground. In June the visible supply of Ohio oil increased another half million barrels.

In July the new production of the Pennsylvania field was 6,543 barrels and in August it was 13,536 barrels. This led Mr. J. S. H. Umsted, the best petroleum authority on the New York press, to remark: "If there is such a thing as commercial suicide, the producers of Pennsylvania petroleum would seem to be bent upon it. They may not be held responsible for Nature's enrichment of the bowels of the earth in the south western counties of Pennsylvania, but it has been the outcome of their voluntary policy that these vast deposits of crude oil have been opened up prematurely, or at least upon a market already weighted by other conditions." The secret of this large increase in production was the phenomenal outflow from wells in the McDonald pool. This district surprised the trade with the greatest gushers ever seen in this country, which surpassed indeed the "oil fountains" that have made Russia unique as well as famous. In 1882 the Cherry Grove district caused a break in the price of oil from above \$1 per barrel to below 50 cents, to the ruin of many well schooled petroleum dealers; but the greatest record that district ever made was 40,000 barrels per day. The McDonald pool doubled that amount in a day, and its average daily yield in September was about 40,000 barrels.

About this time the shipments of Russian oil to Europe were unprecedented. The entire production of the Pennsylvania field was about 120,000 barrels daily; that of Ohio about 47,000, and the production was out-running consumption, with one market in Europe diminished. Still oil held at about 60 cents, without anyone daring to sell it short and with no one sufficiently bold to buy it.

In November past the production was 1,250,000 barrels in excess of shipments and still crude oil held steady. The oil business is a private matter now; it is in the hands of the Standard and the public is not discernible with a telescope or discoverable with a search warrant. The petroleum product is an important factor in American exports, figuring about the fourth in value, but unlike any other great product it is in the hands of one great corporation.

FLUCTUATION IN PRICES PER BARREL (40 GALS.) OF PETROLEUM DURING 1891.

(Consolidated Stock and Petroleum Exchange.)					
Months.	Opening.	Highest.	Lowest.	Closing.	Sales.
January.....	73	78½	72½	75½	886,000
February.....	78	81	75½	77½	685,000
March.....	76½	79	71½	72½	528,000
April.....	73½	74½	66½	66½	463,000
May.....	68	72½	67½	68	516,000
June.....	69	70½	65	65½	538,000
July.....	66½	68½	59½	60	457,000
August.....	62½	70½	51½	61½	1,376,000
September.....	64½	64½	54½	56½	3,647,000
October.....	58	63½	57½	59½	1,584,000
November.....	60½	61½	56½	58	1,131,000
December.....	59½	60½	58½	59½	497,000
Year.....	73	81	51½	59½	12,308,000

(New York Stock Exchange.)					
Months.	Opening.	Highest.	Lowest.	Closing.	Sales.
January.....	71	77½	71	74	328,000
February.....	76½	79½	76	77	128,000
March.....	75½	77½	71½	73	66,000
April.....	73½	73½	68½	69½	70,000
May.....	66½	72	66½	68	211,000
June.....	68	69½	65½	67	103,000
July.....	65	67½	65	67½	11,000
August.....	60½	70	59½	61	205,000
September.....	64	64	55	57	683,000
October.....	57½	62½	57½	59	395,000
November.....	59½	59½	57	59½	229,000
December.....	58½	59½	58	59½	181,000
Year.....	71	79½	55	59½	2,609,000

PHOSPHATES—THEIR PRODUCTION AND CONSUMPTION.

By Francis Wyatt, Ph. D.

Vegetables derive their food value from their starch, gluten, sugar, gum and some organic acids, while the value of animal food is due to albumen, fibrine, fats and small quantities of divers saline matters. All these constitute what are known as proximate principles, the ultimate composition of which is made up of such simple bodies as carbon, hydrogen, oxygen, nitrogen, calcium, potassium, sodium, iron, phosphorus and sulphur. The elements of our food are therefore taken from the air, the water and the soil, and are so fitted together by the plants as to produce the food of those animals termed gramivorous, which, in their turn, afford to us the vast bulk of our animal sustenance. These mysterious inward processes and these marvelous transmutations of inorganic into organic products, through the medium of plants and animals, form the foundation of the phenomena connected with scientific agriculture, the nutrition of plants, and the increase and prosperity of populations. A practical and beautiful illustration of the contrast existing between the respective attributes of vegetables and animals has been furnished by Dumas and Cahours in the following manner:

Pro-duce	{	Vegetables.	Pro-duce	{	Man and Animals.
		Nitrogenous matter, Fatty matter, Gum, sugar, starch.			Nitrogenous matter, Fatty matters, Gum, sugar, starch
Con-sume	{	Carbonic acid, Water, Ammonia. Absorb oxygen, constitute apparatus of reduction and are stationary.	Con-sume	{	Carbonic acid, Water, Ammonia. Absorb oxygen, constitute apparatus of oxidation and are locomotive.

A progressive and eventually complete exhaustion of the soil is thus indicated, and we are naturally brought to realize the necessity for its re-constitution by the aid of chemistry, for the reason that, while man and animals produce those very elements which are so necessary to the renewed existence of plants, they both are locomotive and do not, in practice, give back to the earth what they have borrowed from its stores.

Some rough idea of the actual quantity of mineral matter annually withdrawn from the soil by our food plants may be arrived at if we take a given weight of any cereal—say, for instance, wheat—and burn it until it is reduced to a perfectly white ash. If we next weigh this ash very carefully we shall ascertain that its weight will represent about 2½% of the material burned. In the same manner, if we burn a weighed sample of the straw of the grain, or, let us say, of hay or of clover, we shall find that the residual ash will represent about 6½% of the original substance. A chemical analysis of the two kinds of ash, wheat and straw, will show that the first contains about 40% and the second about 8% of phosphoric acid, and with these figures as a basis, some interesting calculations may be made with approximate accuracy.

The total acreage under cultivation for cereals and grasses in the United States is estimated at 200,000,000 acres, and the total weight of the crops produced from it at 225,000,000 tons.

If the amount of mineral matter contained in this product be estimated at an average of, say, 4% on the gross—which, we think, would be fair—it gives a total of 9,200,000 tons. If the percentage of phosphoric acid in the ash of the grain and in that of the straws and grasses be taken for the purposes of our inquiry at the low average of, say, 20%, the amount of this valuable material yearly abstracted from the soils by our food crops alone attains the gigantic total of at least 1,840,000 tons, or, say, 19 lbs. per acre.

These are large figures, and it would be probably unfair to assume that the whole quantity is altogether lost to the soil. Certain allowances must necessarily be made for farm refuse and for stable manure, but even when these are reckoned with, it will probably be safe to place the actual loss of phosphoric acid at one million tons.

If the average depth of our arable soils in their virgin state be taken at only 9 in., and if we assume them to have contained say 0-10% of phosphoric acid, their original total was, say, 3,000 lbs. per acre; in other words, a sufficient quantity to last for 150 years on the present basis of production.

We must, however, remember that immense bodies of our soil have long been under cultivation; that the science of agriculture is comparatively new; and that it is only within the past 50 years that any considerable attention has been bestowed upon the problem entailed by possible exhaustion. Very serious inroads have therefore already been made upon our reserves of this necessary plant food, and it is recognized that a large, if not the major portion of our older cultivated lands, are already showing premonitory symptoms of impoverishment.

Of recent times, the attention of many intelligent farmers has been very forcibly directed toward this important circumstance; they have been very taught to realize that if production is to go on, the vital elements must be restored to the soil, and they are now using a number of substances known to contain phosphoric acid, for the purpose of making good the losses entailed by their business operations. The following are a few of the principle substances of this kind, the figures placed opposite to them being offered as broadly approximative and without claims to absolute accuracy.

Name of substance.	Average contents in phosphoric acid.	Probable quantity used.
Guanos.....	25%	50,000 tons.
Fish scrap.....	2%	75,000 "
Tankage.....	9%	150,000 "
Bones.....	24%	250,000 "
Bone black.....	32%	
Bone meal.....	30%	700,000 "
Superphosphate of lime.....	12%	
Refuse of various kinds from tanneries, glue factories, oil works, etc., etc.....	3%	300,000 "

It would appear from this data that the total quantity of phosphoric acid purchased in these various forms does not amount to more than about one-fourth of the quantity we have reckoned as taken out of our soils, and either consumed in our cities or exported to feed the peoples of foreign countries every year. It follows, that, without counting the considerable additional acreage yearly coming into the category of exhausted lands, there is an actual and active necessity for the use of at least four times our present consumption of phosphatic fertilizers.

In past and prehistoric ages vast quantities of phosphoric acid have been produced and redistributed over the globe's surface, and these have been stored up for us by nature in the form of phosphates in all sorts of places, more or less easily accessible. We have discovered these phosphates associated with the rocks of all eras and of various textures in veins, pockets and beds, and are now producing it in this country and in Canada, as well as in England, France, Germany, Belgium, Spain, Portugal, Norway, Russia and the West Indies.

The following table of analysis, taken from Wyatt's *Phosphates of America*, will give a good general idea of the composition of the material mined from these various sources:

	Spanish and Portuguese.	Navassa.	Aruba.	Curacao.	German.	French Ardennes.
Moisture.....	1.20	5.73	5.53	0.75	1.27	5.20
Water of combination.....	3.60	4.95	6.03	1.07	2.17	23.45
Phosphoric acid.....	32.36	31.09	32.00	39.02	29.99	40.48
Lime.....	47.28	38.00	43.06	50.04	42.20	4.83
Carbonic acid.....	3.50	2.40	3.30	7.55	4.15	4.87
Oxide of Iron.....	1.93	4.25	3.05	Traces.	5.15	2.15
Alumina.....	1.03	8.81	2.20	0.45	0.12	1.30
Sulphuric acid.....	Traces.	1.10	Traces.	Traces.	Traces.	1.30
Fluorine.....	2.87	1.10	Traces.	Traces.	1.71	0.94
Insoluble silicious matters.....	6.53	3.09	2.11	0.52	13.24	18.68
Equal to tribasic phosphate of lime.....	100.00	100.00	100.00	100.00	100.00	100.00
Equal to tribasic phosphate of lime.....	70.55	69.85	69.75	86.37	65.40	51.22

	Mexillones Guano.	Cambridge Coprolites.	Norway Apatites.	Russian Coprolites.	Somme, France.	Belgian (Average) Calcined.
Moisture.....	10.90	1.24	0.47	5.10	2.00	0.25
Water of combination.....	11.01	2.40	0.36	1.02	1.02	0.25
Phosphoric acid.....	33.70	26.85	42.34	27.48	35.70	20.59
Lime.....	28.00	42.96	51.63	43.00	51.20	52.50
Carbonic acid.....	3.70	7.06	4.60	4.60	4.10	5.55
Oxide of Iron.....	4.16	4.16	3.40	4.10	4.10	18.61
Alumina.....	8.01	3.01	1.09	0.70	0.70	0.70
Sulphuric acid.....	0.76	0.76	1.04	0.76	0.76	0.76
Fluorine.....	1.15	1.15	0.47	1.92	1.92	1.92
Insoluble silicious matters.....	4.68	10.41	13.82	1.20	1.20	2.50
Equal to tribasic phosphate of lime.....	100.00	100.00	100.00	100.00	100.00	100.00
Equal to tribasic phosphate of lime.....	73.45	58.53	92.30	59.97	78.50	45.30

The character of the phosphates of lime thus far discovered in the United States is that of amorphous and nodular deposits which occur in the Tertiary formation, the strata of which may be broadly said to hug the coast of the Atlantic Ocean and the Gulf of Mexico from New Jersey to Texas, embracing within its area the most extensive marl beds in the world. Quarries or mines of more or less commercial value and importance have been located and worked in Virginia, North and South Carolina, Alabama, Georgia and Florida, and there is no reason why phosphates should not be found in large quantities in states where they have only hitherto appeared to be of very low grade. For the present, however, the only sources that are being largely exploited are the vast beds of South Carolina and Florida, and, unless we are misled by appearances, these seem sufficiently extensive if wisely managed to meet all our requirements for an indefinite period.

THE PHOSPHATES OF SOUTH CAROLINA.

The geological formation of the South Carolina phosphate belt is made up of Quaternary sands and clays overlying beds of Eocene marls with the phosphate distributed over their surface or mixed up indiscriminately with them. The total area covered by it is said to be 70 miles long by 30 miles broad; the richest and most accessible portion being in the immediate neighborhood of Charleston. Whether the deposit is continuous or not over the whole of this zone, it certainly varies considerably in depth and thickness. In many places it is 3 ft. thick and crops out at the surface, whereas in others it dwindles down to a few inches, or is found at depths varying from 3 ft. to 20 ft. These two conditions, thickness of deposit and depth of strata, taken together with the richness of material in phosphoric acid, are of course the chief points for consideration in the economic working of the beds on an industrial scale.

In the two kinds of deposits, the "River" and the "Land," the material is of practically the same chemical description. Both have been worked extensively and have proved to be of great commercial value, the first especially so, since it is obtained by the simple and inexpensive process of dredging, and is thus raised and washed from all adhering impurities by one and the same operation.

The rock and nodules are found in very irregular masses, or blocks, of extremely hard conglomerate, and of variegated colors, weighing from less than half an ounce to more than a ton. The mean specific gravity of the material is 2.40, and it is bored in all directions by very small holes. These holes are the work of innumerable crustaceae, and are now filled with sands and clays of the overlying strata. Sometimes the rock is quite smooth or even glazed, as if worn by water; at others it is rough and jagged.

Interspersed between the nodules and lumps of conglomerate are the fossilized remains of various species of fish and some animals, chiefly belonging to the Eocene, Pliocene or post-Pliocene ages.

Very careful analyses of a large number of the samples of land rocks taken from working pits and made by Wyatt gave, after being well dried at 212° F., the following average: Moisture, water of combination and organic matter lost on ignition, 8%; phosphate of lime, 59.63%; carbonate of lime, 8.68%; iron and alumina (calculated as oxides), 6.60%; carbonate of magnesia, 0.73%; sulphuric acid and fluoride of lime, 4.80%; sand, silicious matters and undetermined, 11.56%; total, 100%.

Before the land rock can be made available for industrial purposes, it is made to pass through three distinct and successive operations. 1st,

mining or excavating. 2nd, washing it free from sand and other impurities. 3rd, kilning, to free it from moisture.

The kilns are made sufficiently large and are so arranged as to allow free passage to a train of cars, which, running on the main line of railroad, can be loaded in the kiln, run down to the landing place and discharged directly into the barges or boats on the river. The cost of producing one ton of river rock in dry marketable condition is generally allowed to be about \$5.25 per ton, including \$2.00 royalty, and, with a properly constructed plant, well managed land companies with no royalty to pay, place their cost of production at about \$4 delivered free alongside vessels in Charleston harbor.

The actual selling price has just been lowered to \$6.00 per ton, and of the total quantity moved this year about 100,000 tons were exported, and about 400,000 tons were consumed in this country, principally in Charleston, Richmond, Baltimore, Philadelphia and New York.

As a raw material of the first class in the manufacture of soluble and available phosphates, South Carolina rock will always continue to be everywhere held in the highest esteem. In Europe it is also very popular, and, being of unvarying quality, has yielded results that cannot be surpassed by any other phosphate as an all-round staple, uniform and reliable article.

No absolute opinion can be expressed as to the probable extent and capacity of the yet untouched or unexploited deposits, but, from information which we have been able to gather from reliable sources, it may probably be safely estimated at about thirty miles. Placing the yield of this area at the present average of 750 tons to the acre, the conclusion would be that the State may still produce about 14,000,000 tons.

The known available and readily accessible deposits are said to be all appropriated, and as time rolls on local manufacturing requirements will of course increase in large proportions. It is therefore highly probable that at no distant date this source of consumption will absorb all that can be produced, and that there will be no balance available for foreign markets.

SHIPMENTS OF PHOSPHATE ROCK FROM CHARLESTON, S. C., FROM JANUARY 1ST TO NOVEMBER 30TH, 1891.

Domestic.	Crude tons.	Gr'nd tons.	Total tons.	Domestic.	Crude tons.	Gr'nd tons.	Total tons.
Baltimore.....	71,599			Seaford, Del.....	1,200		1,200
Philadelphia.....	20,188			Montana Creek,			
New York.....	9,790	2,979	12,769	N. J.....	4,239		4,239
Newmouth, Mass.....	17,900			Tremble, N. J.....	1,061		1,061
Newtown Creek,				Alexandria, Va.....	1,860		1,860
N. Y.....	4,085			Savannah, Ga.....	1,753		1,753
Wilmington, Del.....	5,310			Cartaret, N. J.....	5,160		5,160
Richmond, Va.....	10,287			Cooper's Creek...	1,144		1,144
Barren Island.....	5,668			Orient.....	990		990
Wilmington, N. C.....	4,233						
Elizabethport, N. J.....	2,980			Total coastwise.....	170,137	2,979	172,116

Railroads.	Crude tons.	Foreign.	Crude tons.
South Carolina.....	28,565	Gottenburg.....	95
Charleston & Savannah.....	23,707	Liverpool.....	289
Northeastern.....	14,570	Garston & Drogheda.....	2,000
		Genoa.....	2,143
Total by railroad from Charleston.....	66,942	Total.....	4,527

Consumed at Charleston, estimated, 125,000 tons.

FROM BEAUFORT, S. C.

Foreign.	Coastwise.	Total.	July.	Foreign.	Coastwise.	Total.
January.....	7,194	5,739	12,933	5,805	2,068	7,873
February.....	7,576	2,745	10,315	5,753	1,147	6,900
March.....	11,882	809	12,691	6,000	1,000	7,000
April.....	16,012	2,457	18,469	5,000	2,500	7,500
May.....	10,784	1,106	11,890	5,000	1,500	6,500
June.....	12,434	1,273	13,707			
				93,440	22,344	115,778

Consumed at Beaufort, estimated, 15,000.

RECAPITULATION.

From Charleston.....	Foreign Tons.	Coastwise Tons.	Railroads Tons.	Local Tons.	Total Tons.
From Charleston.....	4,527	172,116		125,000	366,585
Beaufort.....	93,440	22,344	66,942	15,000	190,784
Totals.....	97,967	194,460	66,942	140,000	499,369

PHOSPHATE ROCK (WASHED PRODUCT) MINED BY THE LAND AND RIVER MINING COMPANIES OF SOUTH CAROLINA.

Long tons.	1880 year ending May 31.....	Long tons.	1880 year ending May 31.....
1867 year ending May 31.....	6	1880 year ending May 31.....	190,763
1868 " " ".....	12,362	1881 " " ".....	266,734
1869 " " ".....	31,958	1882 " " ".....	332,077
1870 " " ".....	65,241	1883 " " ".....	378,380
1871 " " ".....	74,188	1884 " " ".....	431,779
1872 " " ".....	58,760	1885 " " ".....	395,403
1873 " " ".....	79,203	1885 (June 1 to December 31).....	277,789
1874 " " ".....	109,340	1886 (calendar year).....	430,549
1875 " " ".....	122,790	1887 " " ".....	480,558
1876 " " ".....	132,478	1888 " " ".....	445,567
1877 " " ".....	163,000	1889 " " ".....	548,585
1878 " " ".....	210,322	1890 " " ".....	537,149
1879 " " ".....	199,355	1891 (estimated).....	500,000

THE PHOSPHATES OF FLORIDA.

The existence of nodular amorphous phosphate deposits in Florida is not a matter of recent discovery, for they were found in various directions many years ago, but were never believed to be of sufficient importance either in quantity or quality to merit the serious attention of capitalists. Like many other of our natural resources, therefore, they remained long dormant and unthought of. The geological formation in which the deposits occur has been very fully described in Wyatt's *Phosphates of America* and may be broadly summed up here as being composed of:

1st. Original pockets or cavities in the Vicksburg limestone filled with hard and soft rock phosphates and debris.

2d. Mounds or beaches rolled up on the elevated points, and chiefly consisting of high boulders of phosphate rock.

3d. Drift or disintegrated rock, covering immense areas, chiefly in Polk and Hillsboro counties and underlying Peace River and its tributaries.

The work of exploration or prospecting has now extended all over the State in each of these varieties of the formation, and actual exploitation on the large scale by regular mining and hydraulic methods has been commenced at various points.

In several of the mines, notably in those of Marion and Citrus counties, there are immense deposits of phosphatic material, proved by actual experimental work to extend in many cases over uninterrupted areas of several acres. The deposits in each case have shown themselves to be combinations of the "original pocket" and the "mound" formation, and the superincumbent material, or overburden, is principally sand, and may be fairly said to have an average depth of about 10 ft. The phosphate, immediately underlying it, is sometimes in the form of enormous boulders of hard rock, cemented together with clay, and sometimes in the form of a white plastic or friable mass resembling kaolin, and probably produced by the natural disintegration of the hard rock by rolling, attrition or concussion. The actual thickness of the deposits is too variable to be computed with any accuracy into an average, but it has been known to reach a depth of 50 ft., and a little over two acres only has yielded more than 20,000 tons of good ore, without signs of exhaustion. Directly outside of the limits of these combined "pockety" and "mound" formations the deposits of phosphate seem to abruptly terminate and to give place to an unimportant drift, which sometimes crops out at the surface, and which may be followed in all directions over the immediate vicinity without leading to another pocket of exploitable value.

The same geological phenomena are prevalent in nearly every section of the country, with the exceptions of Polk and Hillsboro counties, where they are somewhat modified. We are, therefore, warranted in declaring that the Florida phosphates of high grade occur in beds of an essentially pockety, extremely capricious, uneven and deceptive nature.

Sometimes the pockets will develop into deep quarries, and will probably yield large quantities of various merchantable qualities. At other times they will be entirely superficial, or will contain the phosphate in such a mixed condition as to render profitable exploitation impossible.

In the case of the "pebble" or "drift" deposits this capriciousness is much less marked, in fact an unusual degree of regularity may be said to characterize their occurrence in the extensive area in which they have been found, and which may be roughly said to take its point of departure in Polk county, a little to the south of Bartow, and thence to practically continue with a gradually narrowing tendency to within a very short range of Charlotte Harbor. The country is flat and swampy, and is intersected at frequent intervals by the Alafia, Manatee, Peace, and other rivers, rivulets and streams.

Pit sinking is now going on over a wide area, and it has been practically demonstrated that this section of Florida is more or less underlaid with a nodular phosphate stratum of a thickness varying from a few inches to 30 ft. and covered by an overburden that may be fairly averaged at about 8 ft.

The actual chief working center for "pebble" phosphates is Peace River, which rises in the high lake lands of Polk county and flows rapidly southward into the Gulf of Mexico. Its course is extremely irregular, and its bottom is a constant succession of shallows and deep basins. Lakes Tsala-Opopka and Chillicoatchee and Pains and Whidden creeks are its chief tributaries and the main sources of its phosphate deposits, the pebbles being washed out from their banks and borne along their beds by the torrential summer rains.

The pebbles when freed from impurities and dried are of a dark blue color and are hard and smooth, varying in size from a grain of rice to about 1 in. in diameter. Their origin is mainly organic, and they are intimately mixed up with the bones and teeth of numerous extinct species of animals, birds and fish.

The river deposits are said to all proceed from the banks of "drift" situated on the higher lands in Polk County, the pebbles being all of the same size and differing only in that those of the land are of a lighter color and imbedded in a matrix of sand and clay to which they frequently bear the proportion of about 20% by weight.

The chemical composition of Florida phosphates, and more especially of those known as "hard rock" or "bowlider," is irregular and variable. Nor is its physical aspect any more uniform, for while in some regions it is perfectly white, in others it is blue, yellow or brown. In many instances it is practically free from iron and alumina, but in some districts it is heavily loaded with these commercially objectionable constituents. A large proportion of the land rock is very soft when damp, but becomes perfectly hard when dried.

The following average analyses by Wyatt are presented for the purpose of generally illustrating the composition of Florida phosphates:

	Phosphate of lime.	Oxides of iron and alumina.	Silica and silicates.	Carbonic acid.
	%	%	%	%
Boulders, carefully selected and cleaned (120 samples).....	80.49	2.25	4.20	2.10
Boulders and debris, as mined (237 samples).....	74.90	4.19	9.25	1.90
Soft white phosphate (148 samples)....	65.15	9.20	5.47	4.27
Pebble from Peace River, as marketed (81 samples).....	61.75	2.90	14.20	3.60
Pebble and drift beds, Polk County, washed and dried (92 samples).....	67.25	3.00	10.40	1.70

In mining the hard rock or high-grade bowlder deposits, careful selection of the different qualities and accurate sampling and analyses of the different piles before shipment are essential. There is at present no remunerative market in this country for the richest grades, and it is therefore probable that for some time to come the major portion will be exported.

Foreign buyers will make no contracts for raw material containing a higher maximum than 3% of oxides of iron and alumina, and shipments must be made within this limit by miners who would establish a good reputation. This necessitates great experience and perfect harmony between the miners and chemist.

The most rational plan is to first crush the rock to a suitable size as it comes from the mine, say, 1 1/2 in., next to pass it through washers and screens, and finally dry it by hot air, avoiding direct contact with fire. The cost of production under these conditions averages about \$5 per ton, delivered on the cars. The actual selling price for Florida phosphates both

"hard rock" and "pebble," in good marketable condition, that is to say with no more than 1% of moisture and a guaranteed maximum of 3% of the combined oxides of iron and alumina, is about 9 c. per long ton unit delivered free on board cars at the mines. The total quantity handed over to commerce this year cannot be very accurately ascertained, but from all we can gather by diligent inquiry about 107,300 tons were consigned to foreign ports and about 53,000 tons were consumed by domestic manufacturers in various parts of the country.

SHIPMENTS OF FLORIDA PHOSPHATES OF ALL GRADES FROM VARIOUS PORTS FROM JANUARY 1ST TO DECEMBER 31ST, 1891.

Rock and Pebble Phosphate.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Totals.
	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Tons.
From Port Tampa:													
Foreign.....		1,326	2,300		3,750	1,100	1,970	1,600		3,690	1,640		17,296
Domestic.....										1,400	1,150	950	5,200
From Fernandina:													
Foreign.....	2,220	4,544	4,508	3,048	4,151	4,190	6,026	4,233	6,000	5,000	4,000	5,020	53,010
Total.....	2,220	5,870	6,898	3,048	7,901	5,290	7,996	7,233	6,000	9,750	6,000	6,700	75,506
From Jacksonville:													
Domestic.....				34	40	83	112	56					
From Lake City:													
Domestic.....				17			18						
From River Junction:													
Domestic.....	1,211	234	1,020	793	654	5,036	539	668					
From Callahan:													
Domestic.....	105	60		195	486	280	273	213					
Totals.....	1,316	294	1,037	1,022	1,180	5,417	924	937					17,000
Charlotte Harbor:													
Foreign.....		1,900		2,000	4,000	3,630	3,000	4,500	4,000	5,000	3,000	4,000	37,000
Domestic.....	3,500			900	2,100		2,300	700	1,000	1,000	2,000	1,000	14,500
Bartow:													
Domestic.....	1,063	1,781	2,431	671	2,056	1,240	970	1,483	1,000	1,000	1,000	1,000	15,725
Totals.....	4,593	1,781	2,431	1,571	4,156	1,240	3,270	2,183	2,000	2,000	3,000	2,000	
Grand total, partially estimated.													159,731

RECAPITULATION.

Total shipments to foreign ports.....	Short tons.
"consumers at home.....	107,300
	52,431

GENERAL OUTLOOK FOR AMERICAN PHOSPHATES.

We roughly endeavored, at the commencement of this article, to show that our own requirements of phosphoric acid, to replace what is taken from the soils by the food crops of the United States amounts to one million tons. We also attempted to prove that of this quantity not more than one-fourth is actually given back to them by artificial means.

A yearly home deficit of some 750,000 tons is thus implied, which, if calculated as phosphate of lime of 60% grade—that being the bulk of our production—would indicate at the very lowest computation a consumptive capacity of 2,500,000 tons, or about five times the quantity actually sold and nearly twice the amount consumed by the entire world.

The difficulty of accounting in any logical way for these anomalous figures would seem to be insuperable, nor can we furnish any better explanation of them than that the great majority of farmers are far from wealthy, and are neither very advanced in knowledge nor sufficiently imbued with the commercial instinct to understand the necessities of their position or the requirements of their soils. In nine cases out of every ten they purchase fertilizers with high sounding names and of needlessly complex composition, and, speaking in a general way, pay for them "through the nose." Their true position may be summed up somewhat as follows:

- 1st. Ignorance of the proper kind of fertilizers required by their soils and for the crops they prefer to produce.
- 2d. Entire dependence upon these crops; their purchasing power being regulated by the returns from their lands.
- 3d. Lack of capital and restricted credit, owing to the existence of mortgages.
- 4th. Purchases of fertilizers under the guidance of some local "middleman" or manufacturer's agent, whose chief preoccupation is to sell that class of fertilizer which leaves the greatest margin of profit to the maker.
- 5th. Frequent destruction of crops, from such natural causes as floods, drought, frost, fire, insects; consequent inability to pay when their notes fall due for the fertilizer purchased, and compulsion to wait for another and more favorable season before they can get out of debt and buy any more.

These circumstances are not exaggerated, and they explain without further discussion the reason why some 75% of our farmers are not to be counted as yearly buyers of artificial fertilizers, and why their consumption of them will always be subject to the fluctuations of their fortunes. From our point of view, the increase in their total demands will always be a gradual one, and while it may go by leaps and bounds in some years, it is invariably liable to a retrograde movement during others. The coming season, for example, may be one of great activity in this country, for the crops have been exceptionally large, and prices are above the average. By the same reasoning, on the other hand, we may expect a decreased consumption by our chief foreign customers, for in their case the crops have fallen short, and they will be compelled to invest their savings in our breadstuffs rather than in our phosphates.

That the fertilizer industry must perforce conform to the laws which govern demand and supply; and that it is wholly impracticable to force uncalled for quantities of material upon an unprepared and unwilling market, has perhaps never been so aptly illustrated as by recent experiences in phosphate mining, some of which may well be very briefly recalled at this juncture in defense of the soundness of our position.

When the Florida phosphate beds were discovered and developed, two years ago, there broke out at the South a perfect fever of speculation. At that time our total annual output of phosphate was about 500,000 tons, nearly all of which was raised in South Carolina, about 200,000 tons being exported and the balance used at home.

The difficulties between the Coosaw Company and the State authorities had just then arisen; the temporary suspension of this company's gigantic operations threatened a considerable decrease in production; buyers became anxious to secure their needed supplies, and sellers advanced their prices from \$7 to \$7.50 per ton.

To the initiated, this was an intelligible and natural situation, on the one hand there was the Coosaw deficiency of 100,000 tons; on the other there were the customers of this company, anxious to supply their needs and ready to abide by a rise in price, rather than be left unsatisfied. An activity was thus imparted to the industry, but it was misunderstood, and few, if any, of those who rushed into the Florida fields took the trouble to inquire into its true inwardness. To them, only one phase was prominent, phosphates were in demand; there were millions of tons in Florida ready for exploitation at an exceptionally low price, and of exceptionally high quality.

The interesting facts that the consumptive capacity of the entire world does not attain 2,000,000 tons of mineral phosphates of all kinds and qualities; that three-quarters of this quantity are being produced in other countries from mines as rich as our own; that South Carolina might be equal to any extra demands upon her, were all ignored or disregarded.

So were the very tangible difficulties of Florida's climatic inconveniences, her lack of good and accessible ports, her restricted railroad accommodation, her scarcity of water and unreliable labor. Thus, company succeeded company, exaggerated values were placed upon lands, the possibilities of production were ridiculously overestimated; and in lieu of looking to this country for an outlet, general attention was turned to Europe as a more proper, because unlimited (*sic*), consumer.

The immediate result of such a "boom" and of such ignorance has been widespread and deplorable. The foreign buyers, who were at first so skeptical, have become seriously alarmed and, so far from being in anxiety as to their future supplies, see themselves menaced with a glutted market, and realize the impossibility of finding an outlet, in any of the ordinary channels of trade, for such a flood of material as that with which they are threatened. Instead of the firm and rising price of a year ago, we are confronted by quotations which, having continually gone down, now stand at a limit at which most foreign mines have been compelled to stop working, and at which even South Carolina, despite her natural advantages, will find it hard to make both ends meet.

If the "boom" had resulted in any serious increase in the consumption of our phosphates either at home or abroad, even though prices were thereby lowered and mining profits reduced, there would be grounds for congratulation, but, as we may perceive by a study of our figures, this is unfortunately not the case.

In the year 1890 our total sales from all sources amounted to about 600,000 tons, and our average prices were \$7 per ton for 60%, and \$12 per ton for 75% to 80%, both free on board vessels. During the year 1891 we sold about 660,000 tons, and the surplus quantity of 60,000 tons was sufficient to break the markets of the world and to reduce quotations to \$6 and \$9 per ton for the same respective qualities.

This remarkable disturbance, caused by so small a surplus—a large portion of which was of such exceptionally high grade and good quality—graphically illustrates the want of flexibility in the fertilizer markets which we have endeavored to describe. It argues badly for the immediate future and should in our opinion be a significant warning to our producers not to further overstep the bounds of prudence.

Whether the lost equilibrium can be restored now that such important interests are conflicting, and how and when phosphate mining can again become a profitable undertaking, are serious problems; so serious indeed that we hesitate to prognosticate.

One thing, however, is certain—we must look forward to the speedy collapse of a large majority of Florida's paper companies, and, when they have disappeared, to a recognition by the more solid ones of the veritable situation, before we can hope for any sensible relief. The dissipation of that delusion which is based upon the supposed inexhaustibility of the deposits, and which relies upon a nominal cost and phenomenal returns, will also materially contribute to a solution.

When once she reaches her proper level, the future of Florida as a phosphate producer will be assured. She will fall into the ranks as a large contributor, and, as consumption increases, will be able to command remunerative prices. She will of course soon discover that her high grade rock is far less plentiful than has been generally supposed, and in fact we venture to say that her average annual production of 75% material will never exceed 50,000 tons, and will soon be much less than that figure.

Her river and pebble material will be more plentiful, but in mining it economically many difficulties must be encountered and overcome. No settled method of exploiting and putting it into the market in the necessary merchantable condition has thus far been generally adopted, and it is therefore impossible to form any true estimate as to production for the immediate future.

PRECIOUS STONES.

By Geo. F. Kunz.

From the customs import lists, after deducting the approximate value of cut stones other than diamonds, we find that import duty was paid on about \$120,000,000 worth of cut diamonds in the last 24 years, of which \$90,000,000 worth were imported during the last 12 years. In 1868 \$1,000,000 worth were imported and about \$1,200,000 worth in 1867, but about \$11,000,000 worth in 1888, and in 1889 about \$13,000,000, or 10 to 12 times as many as 20 years previous, showing the increase of wealth and the great popularity of the diamond among Americans, the previous figures representing the import prices, exclusive of mounting or dealers' profits, and no account taken of those smuggled.

The probable value of all the diamonds in the world is estimated at over one billion dollars. The entire diamond trade is carried on by 8,000 dealers, with a total stock of not far from \$350,000,000. These stones are prepared for market by perhaps 4,500 cutters and polishers, principally in Amsterdam, Antwerp, Paris, the Jura Mountains and the United States. A limited amount of cutting is also done in England. About 200 men cut diamonds in the United States. The diamond cutting industry is developing rapidly in this country. In New York there are 16 firms engaged in cutting and recutting diamonds, and in Massachusetts there are three. Cutting has also been carried on at times in Pennsylvania and Illinois, but has been discontinued.

Forty million carats of diamonds, weighing over nine tons, have been found in South Africa. In the rough their aggregate value was \$250,000,000, which is more than the entire diamond yield of the world during the past two centuries. Of the whole production perhaps 8% are of first water, 12% of the second, and 25% of the third, while the remaining 45% is known as boart.

Up to the present time there has been very little mining for precious stones in the United States and this only at irregular intervals. It has been carried on during the past few years at Paris, Me.; near Los Cerrillos, N. M.; in Alexander County, N. C., from 1881 until 1888; and on the Missouri River, near Helena, Mont., since the beginning of 1890. True beryls and garnets have been found frequently as a by-product in the mining of mica, especially in Virginia and North Carolina. A very limited number of diamonds has been found in the United States. They are met with in well defined districts of California, North Carolina, Georgia, and recently in Wisconsin, but up to the present time the discoveries have been rare and purely accidental. As to sapphires, none of the fine blue color have been found. The same fact is true of rubies of fine red color. The only locality which has been at all prolific is the placer ground between Ruby and Eldorado bars, on the Missouri River, 16 miles east of Helena, Mont. Here sapphires are found in glacial auriferous gravels while sluicing for gold, and until now have been considered only a by-product. The colors of the gems obtained, although beautiful and interesting, are not the standard blue or red shades popular with the public. The emerald has been mined to some extent at Stony Point, in Alexander County, N. C., and has also been obtained at two other places in the County. Turquoise, which was worked by the Aztecs before the advent of the Spaniards, and since then by the Pueblo Indians, and largely used by them for ornament and as an article of exchange, is now systematically mined near Los Cerrillos, N. M.

The finest garnets and nearly all the peridotites found in the United States are obtained in the Navajo Nation, in the northwestern part of New Mexico and the northeastern part of Arizona, where they are collected from ant hills and scorpion nests by Indians and by the soldiers stationed at adjacent forts. Generally these gems are traded for stores by the Indians at Gallup, Fort Defiance, Fort Wingate, etc., whence they are sent to large cities in the East in parcels weighing from half an ounce to 30 lbs. or 40 lbs. These garnets, which are locally known as Arizona and New Mexico rubies, are the finest in the world, rivaling those from the Cape of Good Hope. Fine gems weighing from two to three carats each and upward when cut are not uncommon. The peridotites found associated with garnets are generally four or five times as large, and from their pitted and irregular appearance have been called "Job's tears." They can be cut into gems weighing three or four carats each, but do not approach those from the Levant either in size or color.

SOUTH AFRICAN DIAMOND MINING.

The production of the diamond mines of Griqualand West, South Africa, has been steadily declining during the past three years. This does not, however, appear to be due to any falling off in the supply of precious stones, but rather to the measures taken for the restriction of production by the larger companies which have recently absorbed many of the smaller undertakings. The great object of the consolidation of a number of small companies and subsequent restriction of output was to increase the price of diamonds, and it seems from the statistics of diamond mining in South Africa that this step has been so far successful. The amount and value of the output of these mines in 1890 has not yet been officially returned. For the three years preceding the statistics are as follows:

Mine.	1887.		1888.		1889.	
	Carats.	Value.	Carats.	Value.	Carats.	Value.
Kimberley	1,333,832	£1,410,208	1,332,809	£1,270,873	816,135	£1,132,490
De Beers	1,014,048	1,022,878	1,003,406	335,141	947,195	1,312,372
Dutoitspan	696,576	987,254	569,013	758,464	45,336	897,586
Bultfontein	69,246	61,963	659,887	642,763	541,301	745,817
River diggings	45,365	92,706	31,980	61,081	29,492	73,285
*Total	3,692,067	£4,126,039	3,597,095	£3,668,575	2,784,459	£4,168,050

* In addition, the St. Augustine mine, which was worked intermittently, produced during the three years 427 carats, valued at £609. The Otto's Kopje mine produced during the same time 665 carats, valued at £691.

The average value of the diamonds raised at the Kimberley mine in 1889 was \$6.74 per carat; in 1887 the average value was but \$4.89. Similarly, at the De Beers mine the average value increased from \$4.89 per carat in 1887, to \$6.73 in 1889. At the Dutoitspan mine there was an advance from \$6.88 per carat in 1887, to \$9.48 in 1889; at the Bultfontein mine from \$4.94 to \$6.70; at the St. Augustine from \$6.16 to \$8.12; at the Otto's Kopje from \$4.51 in 1888, to \$7.32; and at the river diggings and mines from \$9.93 in 1887, to \$12.90 in 1889. It will be observed that the most valuable diamonds are raised from the river diggings. The number of persons employed in the diamond mines of Griqualand, West in 1890 is officially returned as 7,249, as compared with 8,102 in 1889, and 11,453 in 1888.

QUICKSILVER.

By J. B. Randol, Manager of the Quicksilver Mining Company of California.

The sage remark of a now eminent mining engineer, who concluded a long report with "the mine looks well but pays badly," applies to the position of the quicksilver market near the end of the year 1891. The production of quicksilver has decreased and the stocks are less, and therefore the statistical position looks well; but the price has fallen and the outcome pays badly.

The returns presented by Messrs. Joseph Bennett Bros. for October 31st, 1891, shows for the London market, the most important of all, as follows:

	1890.	1891.
Imports from January 1st to October 31st.....	Bottles* 58,318	60,742
Exports ".....	" 50,071	49,364
Imports for October.....	" * 2,325	1,257
Exports ".....	" * 2,934	7,124
Price per bottle.....	£10	£8
Stock in London to October 31st (estimated).....	" * 39,500	30,500

*About.

The English Board of Trade returns are so admirably prepared that it is possible to place some dependence upon them, and it is to be supposed that Messrs. Bennett Bros. properly give the quicksilver items. Compared with 1891, the stock November 1st, 1890, 39,500 flasks, was 30% more and the price, £10, was 25% more, as against 30,500 flasks and £8.

It is quite probable the imports and exports show the fullest extent of the possible competition with the California product, which comprises all worthy of notice in the United States.

The customs returns for the United States altogether, or nearly so, ignore the movement of quicksilver into or out of the country, and this is particularly the case with the large quantity in transit, as at most custom houses quicksilver is included under the heading "Other Metals," and required information can only be obtained in a somewhat uncertain way.

The production of quicksilver in the United States for the year 1891 will be about 21,022 flasks, and the estimated stock on hand at close of year not to exceed 3,500 flasks—and quite likely less. The following table gives the production of the several California mines for seven years past:

Mines.	PRODUCTION OF THE CALIFORNIA MINES FOR SEVEN YEARS.							1891.
	1885.	1886.	1887.	1888.	1889.	1890.	1891.	
New Almaden.....	21,400	18,000	20,000	18,000	13,100	12,000	8,000	8,000
Atna.....	1,309	3,478	2,694	959	.....	931	670	670
Napa Con.....	2,197	1,769	2,880	4,065	4,590	2,498	3,650	3,650
Great Western.....	3,469	1,949	1,446	625	556	1,334	1,700	1,700
Sulphur Bank.....	1,296	1,449	1,890	2,164	2,283	1,608	1,223	1,223
New Idria.....	1,144	1,406	1,490	1,320	980	977	700	700
Creat Eastern.....	446	735	689	1,151	1,345	1,046	1,437	1,437
Redington.....	385	409	673	126	812	505	442	442
Guadalupe.....	75	.....	.....	.....	.....	.....	.....	.....
Bradford.....	.....	.....	1,543	3,848	1,874	1,240	1,700	1,700
Various.....	392	786	455	992	924	737	1,580	1,580
Total flasks.....	32,073	29,981	33,761	33,250	26,164	22,926	*21,022	
Lowest price.....	\$28.50	\$32.00	\$36.50	\$37.00	\$40.00	\$47.00	\$39.50	
Highest price.....	32.00	39.00	48.00	48.00	50.00	58.00	51.00	
Average.....	30.25	35.50	42.25	42.50	45.00	52.50	45.25	

* This is a near approximation, the December production being estimated.

Under the heading of "Various" is included a few flasks from Oregon, as well as the production of some small mines in California. The output for 1889 was 26% more, and in 1890 9% more than in 1891. The probable production for 1891 will not exceed 15,000 flasks, and there is good reason therefore to believe we may confidently expect a fair increase in price over the low figures for 1891.

The rumors of new mines have been quite as numerous as in former years and fully as unreliable. The general result is shown in the following, copied from a California paper: "The cinnabar miners on the west fork of Beaver Creek, Siskiyou Mountain," says the *Yreka Journal*, "have shut down the furnaces, and will devote their time in drifting to find a permanent ledge. "Instead of finding a mountain of cinnabar, as at first supposed, the clay adjoining the float cinnabar contains no quicksilver; hence the change in operation."

QUICKSILVER PRODUCTION IN THE UNITED STATES.

Year.	Yield in California.	Average price.	Approximate valuation.	Year.	Yield in California.	Average price.	Approximate valuation.
1850.....	7,725	\$99.45	\$768,000	1870.....	30,077	\$57.37	\$1,725,500
1851.....	27,779	66.92	1,859,000	1871.....	31,685	63.10	1,999,500
1852.....	20,000	58.32	1,166,500	1872.....	31,621	65.97	2,086,000
1853.....	22,284	55.45	1,235,500	1873.....	27,642	80.32	2,226,500
1854.....	30,064	55.45	1,665,500	1874.....	27,756	105.17	2,919,000
1855.....	33,000	53.65	1,768,000	1875.....	50,250	84.15	4,221,000
1856.....	30,000	51.65	1,540,500	1876.....	75,074	44.00	3,303,000
1857.....	28,204	49.72	1,402,000	1877.....	79,396	38.30	3,041,000
1858.....	31,000	47.82	1,482,500	1878.....	63,880	32.90	2,101,500
1859.....	13,000	63.12	820,500	1879.....	73,684	29.85	2,199,500
.....	242,994	56.45	13,717,000	.....	491,066	49.53	24,322,500
1860.....	10,000	53.55	535,500	1880.....	59,926	31.00	1,860,000
1861.....	35,000	42.10	1,473,500	1881.....	60,851	29.80	1,810,000
1862.....	42,000	36.35	1,523,500	1882.....	52,732	28.25	1,500,000
1863.....	40,531	42.07	1,705,000	1883.....	46,725	27.25	1,275,000
1864.....	47,489	45.90	1,761,500	1884.....	31,913	30.50	975,000
1865.....	53,000	45.90	2,433,000	1885.....	32,073	30.25	970,000
1866.....	46,550	51.62	2,403,000	1886.....	29,981	35.50	1,060,000
1867.....	47,000	45.90	2,157,000	1887.....	33,760	42.25	1,425,000
1868.....	47,723	45.90	2,191,000	1888.....	33,250	42.50	1,415,000
1869.....	33,811	45.90	1,552,000	1889.....	26,464	45.00	1,190,500
.....	403,109	44.00	17,738,000	.....	407,675	33.07	13,480,500
1890.....	22,926	52.50	1,203,615	1891.....	21,022	45.25	951,245

THE WORLD'S PRODUCTION OF QUICKSILVER FOR TEN YEARS.

Year.	Total of all mines, United States.		Almaden mine, Spain.	Idria mines, Austria.		Italian mines.	Total foreign.	Grand total, yearly.
	Flasks.	Value.		Flasks.	Value.			
1880.....	59,926	19,168	10,510	3,410	52,242	19,168	119,168	
1881.....	60,851	19,033	10,510	3,410	52,242	19,033	120,933	
1882.....	52,732	18,521	10,510	3,410	41,712	18,521	115,221	
1883.....	46,725	15,119	10,510	3,410	32,805	15,119	107,659	
1884.....	31,913	10,828	10,510	3,410	17,993	10,828	64,644	
1885.....	32,073	10,828	10,510	3,410	17,993	10,828	64,644	
1886.....	29,981	10,354	10,510	3,410	16,061	10,354	59,336	
1887.....	33,760	10,354	10,510	3,410	19,740	10,354	64,264	
1888.....	33,250	10,914	10,510	3,410	19,330	10,914	64,964	
1889.....	26,464	10,126	10,510	3,410	12,544	10,126	52,644	

IMPORTS OF QUICKSILVER INTO THE UNITED STATES.

Years.*	Pounds.	Value.	Years.*	Pounds.	Value.	Years.*	Pounds.	Value.
1867.....	6,870	\$20,957	1883.....	1,552,738	\$593,367			
1868.....	152	68	1884.....	136,615	44,035			
1869.....	11	11	1885.....	257,659	90,416			
1870.....	239,223	107,646	1886.....	629,888	249,411			
1871.....	304,965	137,332	1887.....	419,934	171,431			
1872.....	370,353	189,943	1888.....	132,850	56,997			
1873.....	99,898	74,146	1889.....	341,514	162,064			
1874.....	51,202	32,093	1890.....	802,871	445,807			

* Calendar years ending December 31st from 1836; previous years ending June 30th

§ALT.

By F. E. Engelhardt, Ph. D.

The production of salt in the United States, both for domestic and technical purposes, is accomplished in three different ways—by mining, solar evaporation, and artificial heat.

Rock Salt.—The mining of salt is at present prosecuted at Petit Anse, in Louisiana; at Piffard, Livingston County, N. Y.; at Kanopolis, Ellsworth County, at Lyons, Rice County, and at Kingman, Kingman County, Kansas. In Nevada some rock salt is obtained in Churchill, Washoe and Elko counties, mainly for use in the mining industry. The same is true in regard to Utah, California and Arizona.

The depths of these rock salt deposits vary considerably. At Petite Anse the rock salt stratum is encountered from 16 ft. to 25 ft. below the surface, and its thickness, as ascertained two years ago by the diamond drill, is over 1,000 ft. This salt is of remarkable purity, and if it were not for a peculiarity, namely, that after grinding it very soon becomes almost as hard as before, or in other words, it "cakes," it would have had a much greater and more extended market, especially as a table salt. However, this difficulty is now, according to the manager of the works, entirely overcome. The geological age of this rock salt deposit is at present considered as most likely that of the Quaternary.

In the Retsof mine, at Piffard, in Livingston County, N. Y., the first rock salt vein is over 1,000 ft. below the surface, and the total thickness of the rock salt deposit between 83 ft. and 87 ft., occurring in three main veins—6 ft., 22 ft. and 59 ft. respectively. This mine has been worked very successfully for about six or seven years, and at present yields, unquestionably, 600 tons per day, or about 1,500,000 barrels of 280 lbs. each per year. The salt from this mine, as well as that obtained at the Kansas mines, is more or less impregnated with finely divided particles of a dark colored clay (though there are large portions of the rock salt in these mines, especially in Kansas, that are perfectly clear and free from any admixture) which give to the main body of the salt a dirty appearance as compared with the Petite Anse salt, and in consequence this salt, even when ground very fine, retains a gray appearance. When this kind of salt is dissolved in water these dark clay particles sink to the bottom, and a perfectly clear pickle is obtained by filtration or settling. The geological age of the Retsof salt, and that of all the rock salt in the State of New York, which furnishes the brine in Onondaga, Livingston, Wyoming and Genesee counties is the Upper Silurian. There are now being sunk a new shaft at Greigsville, near the Retsof, and one at Livonia, in Livingston County. Another shaft has been started during the year, south of Le Roy, Genesee County. Thus the State of New York will have in a short time four salt shafts which, when fully equipped, will be capable of furnishing 6,000,000 barrels of salt per year.

The rock salt deposit in Kansas varies in thickness according to locality. Thus at Ellsworth it is given as 140 ft.; at Lyons, 250 ft.; at Hutchinson, 250 ft.; at Kingman, 200 ft.; at Anthony, 75 ft.; at Great Bend, 125 ft.; and at Sterling 198 ft. In Ellsworth the salt stratum is reached at 730 ft. below the surface: at Lyons, at 785 ft.; at Hutchinson, at 450 ft.; at Kingman, at 665 ft., and at Anthony at 925 ft. Thus far five shafts have been sunk; namely, one at Kanopolis, two at Lyons and two at Kingman. The rock salt production from these shafts has up to date been but limited, amounting to less than 200,000 barrels for the year 1891. This is partly due to the fact that they have been sunk but very recently; namely, within the last two years, and therefore were not fully prepared; secondly, to the great competition they had to meet from the Petite Anse and Retsof rock salts and the Michigan fine salt; and thirdly, that the use of rock salt, especially when not perfectly clear and white, is but limited, its use being restricted to the making of salt pickle for meats, cooling mixtures, etc. The Kansas rock salt deposits are at the base of the Triassic formation, according to Prof. Robert Hay, F. A. G. S.

The entire production of rock salt in the United States during the year 1891 was about 2,000,000 barrels.

Solar Evaporation.—Two kinds of salt are produced by solar evaporation in this country, viz., sea salt and the so-called "solar salt."

Sea salt is made in Massachusetts at South Dartmouth, Bristol County, and at East Dennis, Barnstable County, though the quantity is at present very small. The great bulk of sea salt is obtained in California in the Bay of San Francisco, especially in the County of Alameda, where there are at present over 25 works. In Los Angeles and San Diego counties, bordering on the Pacific, there are also several works in which sea salt is produced. Of the salt lakes of the United States which furnish salt by solar evaporation, the most important one is the Great Salt Lake in Utah. The main works are situated in the counties of Davis and Weber, which border on its shores. In Texas there is a lake, "La Sal Del Rey," with a depth of water from 3 ft. to 4 ft., entirely underlaid with a solid salt crust of remarkable purity, which furnishes salt for local consumption.

The production of solar salt from natural brine in wooden vats is, properly speaking, an American method, and was first practiced on our coast many years ago, whence it was introduced into Onondaga County, N. Y., about the year 1821-1822. The present erections are capable of producing in a good year over 600,000 barrels of this salt. Of other localities using this plan there may be mentioned: Bay and Saginaw counties, Michigan; Van Zandt and Colorado counties, Texas, and Salomon City and Salina, Kansas, besides some smaller works in other states. The total production of solar salt, both from sea water and natural brines, is at present about 1,000,000 barrels per annum.

Salt by Artificial Heat.—The brine springs of the United States which serve to-day for the manufacture of salt by artificial heat are distributed

over a wide territory, and occur in several geological formations. The most important one, both in age and extent, is unquestionably the salt deposit in the Upper Silurian, which, as far as our knowledge goes to-day, extends from Madison County, in the State of New York, under Lake Erie and the Peninsula of Michigan. Thus rock salt has been found in New York at Morrisville, Madison County; in the town of Tully, Onondaga County; at Ithaca and Ludlowville, Tompkins County; at Aurora, Cayuga County. In Dansville, Mount Morris, Cuylerville, Livonia, Lakeville, Piffard, Greigsville and York, in Livingston County, wells have been sunk into the rock salt. At Castile, Silver Springs, Perry, Rock Glen, Warsaw, Wyoming and Pearl Creek, in Wyoming County, beds of rock salt have been penetrated. Also at Pavillion and Le Roy, in Genesee County. In Erie County it has been found at East Aurora. Passing into Ohio, it has been struck at Cleveland, on Lake Erie; at Wadsworth, in Medina County, and at Akron, in Summit County. In Michigan, rock salt has been found in this formation along the St. Clair River and the lake of the same name, and in the counties of Bay, Alpena, Manistee, Mason and Muskegon. In the Province of Ontario, Canada, it occurs along the shore of Lake Huron, at Kincardine, Goderich, Clinton, Seaforth, Stapleton, Exeter, and other places.

The thickness of the salt stratum and its depth from the surface in these various localities are very variable. At Morrisville, Madison County, N. Y., it is 12 ft. thick and 1,259 ft. below the surface. At Tully, in Onondaga County, the thickness in 21 wells varies from 25 ft. to 318 ft. at a depth of from 974 ft. to 1,465 ft. At Ithaca, Tompkins County, the seven

serve anthracite coal dust, bituminous coal and wood. The production of salt by artificial heat during the year 1891 will amount to 7,300,000 barrels.

There are no new improvements in the manufacture of salt to be recorded for the year 1891. Due to the great competition the quality of the various grades and kinds of salt is improving year by year, forcing more and more the foreign salt out of the market, which fact is well illustrated by the decline in the importation of English salt. In the year 1880 we imported from England over 2,000,000 barrels, while this year the amount is less than 800,000 barrels. The demand for salt of one kind or another in the United States per year is about one bushel (56 lbs.) per inhabitant, and of the 12,000,000 consumed during the year 1891 fully 10,225,000 barrels have been produced in this country. The prices obtained in the beginning of the season were in a number of localities too low to be remunerative, hence the manufacture of boiled salt was somewhat restricted.

The present capacity of the works making salt by artificial heat in the United States is at least 12,000,000 barrels, to which must be added 3,000,000 for "sea" solar and rock salt, the capacity being consequently considerably in excess of our present demand. Over-production during certain parts of the year was the main cause of the low prices. The demand of salt for other manufacturing enterprises is at present insignificant as compared to our producing capacities, and our largest manufacturing enterprise, the "Solvay Process Company," uses in its soda ash works brine obtained from its own wells at Tully.

PRODUCTION OF SALT IN THE UNITED STATES, BY STATES AND TERRITORIES, FROM 1885 TO 1891, INCLUSIVE.

States and Territories.	1885.		1886.		1887.		1888.		1889.*		1890.*		1891.*	
	Quantity	Value.	Quantity	Value.	Quantity	Value.	Quantity	Value.	Quantity	Value.	Quantity	Value.	Quantity	Value.
Michigan.....	3,297,403	\$2,967,663	3,677,257	\$2,426,989	3,944,300	\$2,291,842	3,866,228	\$2,261,743	3,846,979	\$2,088,909	3,838,637	\$2,111,250	3,927,671	\$2,134,653
New York.....	2,304,787	874,258	2,431,563	1,243,721	2,353,560	936,894	2,418,483	1,130,409	2,400,000	1,296,000	2,985,600	1,671,936	3,532,600	1,949,930
Ohio.....	306,847	139,450	400,000	260,000	365,000	219,000	380,000	247,000	350,000	132,500	325,000	195,000	307,000	264,000
West Virginia.....	223,184	145,070	250,000	162,500	225,000	135,000	220,000	143,000	200,000	110,000	250,000	150,000	275,000	192,500
Louisiana.....	259,271	139,911	239,691	108,372	341,033	118,735	394,385	134,252	350,000	20,000	278,460	158,786	235,620	134,303
California.....	221,428	160,000	214,283	150,000	200,000	140,000	220,000	92,400						
Utah.....	107,140	75,000	164,285	100,000	325,000	102,375	151,785	32,000						
Nevada.....	28,593	20,000	30,000	21,000					350,000	175,000	375,000	187,500	400,000	200,000
Kansas.....							155,000	189,000						
Texas.....									1,250,000	900,000	1,400,000	1,008,000	1,200,000	780,000
Other States and Territories.....	250,000	243,993	240,000	352,763	250,000	150,000	350,000	143,999	250,000	120,000	275,000	132,000	100,000	59,000
Total.....	7,038,653	\$4,825,345	7,707,081	\$4,825,345	8,003,962	\$4,063,846	8,055,881	\$4,374,203	8,996,979	\$5,082,409	9,727,697	\$5,614,472	10,229,691	\$5,872,186

* Partly estimated. † Weighing 280 lbs.

rock salt veins have a thickness of 248 ft., and the first salt vein is reached at 2,244 ft. below the surface. In the Genesee Valley and the territory tributary to its watershed are situated, starting from north to south, the wells of York, Lakeville, Livonia, Piffard, Greigsville, Cuylerville, Mount Morris and Dansville. The rise of the ground is from north to south, and the dip of the formation about 40 ft. per mile in the same direction, which facts explain the difference of the depth from the surface to the salt, which in the 20 miles is from 750 to 2,100 ft., and the thickness of the salt from 40 to 93 ft. In the Wyoming Valley, enumerating the localities in the same manner, we have Le Roy, Pavillion, Pearl Creek, Wyoming, Warsaw, Rock Glen, Perry, Silver Springs and Castile, with a depth to the salt in the 25 miles from 610 ft. to 2,370 ft., and a thickness of salt from 20 ft. to 85 ft. The dip of the formation and the rise of the ground is about the same as in the Genesee Valley.

In the first well at Cleveland, O., the rock salt-bearing stratum was reached at 1,990 ft., having a thickness of 239 ft. with four salt veins; while in the Van Campen well at Wadsworth, Medina County, the first salt vein was struck at 2,575 ft., with a thickness of 240 ft. of the salt bearing stratum and six rock salt veins.

The rock salt deposits of the Upper Silurian in Michigan were reached at Marine City at 1,633 ft. with 115 ft. of salt below, and at St. Clair at 1,635 ft. with 35 ft. of salt. Salt has also been found at Caseville in Huron County, at 1,164 ft.; at Bay City, on Saginaw Bay, at 2,085 ft., with rock salt of 115 ft. thickness. Manistee has 34 ft. of salt at 2,000 ft. depth, and Muskegon, in the Mason well, 50 ft. of salt at 2,200 ft. depth.

The next formation in age and extent which is saliferous is the Carboniferous. A great part of the Michigan brines, especially those at East Saginaw and vicinity, come from the Napoleon sandstone which underlies the Carboniferous and serves as a reservoir for these brines. The extent of this formation in Michigan is given by the late Prof. Alex. Winchell at 17,000 square miles. The same formation is supposed to furnish the brines of the Ohio Valley, and those of Western Pennsylvania, while the Coal Measures are supposed to be the source of most of the brines at Bay City in Michigan, of the valley of the Great Kanawha River in West Virginia, and of the State of Indiana. The rock salt found on the Holston River, at Saltville, Washington County, in Southwestern Virginia, is supposed by Prof. Lesley to belong probably to the Tertiary age, and to occupy but a limited basin. Finally, the rock salt deposits in Kansas are at the base of the Triassic, according to Prof. Robert Hay.

The methods of manufacture of salt by artificial heat and direct fire, are the kettle method as practiced in Onondaga County, N. Y., for the last hundred years almost exclusively, and the pan method employed partly in Western New York, Michigan and Kansas. This is the only method in which the grain of the salt made is in the hands of the workman. Steam is used in the grainer and vacuum pan systems. The greater part of the salt made to-day in the United States by artificial heat is the product of the grainer which is operated in Western New York, Michigan and Kansas. The vacuum pan salt industry is up to date but little introduced, though the product is a most beautiful salt for the table and dairy when made of a pure brine. The works in the Ohio Valley and Western Virginia have a method of their own which is well adapted for the weak brine usually operated on. As fuel for artificial evaporation

IMPORTS AND EXPORTS OF SALT INTO AND FROM THE UNITED STATES.*

Years.	Imports.		Exports.	
	Quantity. Bushels of 56 lbs.	Value.	Quantity. Bushels of 56 lbs.	Value.
1867.....	8,638,843	\$1,032,872	605,825	\$304,030
1868.....	9,436,091	1,251,004	624,970	289,396
1869.....	9,897,285	1,246,440	442,947	190,076
1870.....	12,622,368	1,392,116	298,112	119,582
1871.....	11,131,062	1,221,780	120,156	47,115
1872.....	10,244,656	1,161,617	42,603	19,978
1873.....	12,754,694	1,866,596	73,323	43,777
1874.....	15,915,779	2,228,895	31,657	14,701
1875.....	14,824,872	1,869,259	47,094	16,273
1876.....	14,812,589	1,741,862	51,014	18,378
1877.....	16,705,173	1,733,559	65,771	20,133
1878.....	15,494,966	1,643,802	72,427	24,968
1879.....	16,144,406	1,778,565	43,710	13,612
1880.....	17,138,194	1,848,174	22,179	6,613
1881.....	19,198,937	2,044,968	45,455	14,752
1882.....	18,425,811	1,708,190	42,085	13,265
1883.....	15,498,408	1,641,618	54,147	17,321
1884.....	16,231,746	1,649,918	70,014	26,007
1885.....	16,136,899	1,538,316	73,242	26,448
1886.....	14,063,113	1,432,714	86,226	29,870
1887.....	12,930,872	1,285,359	83,662	27,075
1888.....	11,850,071	1,030,330	95,700	32,986
1889.....	9,171,980	941,213	111,746	33,837
1890.....	9,604,046	932,905	160,023	35,233

* Calendar years ending December 31st, from 1886 to 1890; previous years end June 30th.

Mineral Production of Hungary.—Hungary possesses rich deposits of iron, copper, lead, quicksilver, gold, silver, nickel, cobalt, antimony, tin and zinc. After iron, however, only the extraction of copper, lead, gold and silver forms industries of any importance. Apart from the iron industry, the country may be divided into three metal working districts, namely, Schemnitz, Nagybanya and Zolotna. The total quantity of fine gold produced in Hungary in 1890 was 2,300 kilos., valued at 3,214,080 florins (the florin is equivalent to 48.2 cents); and of fine silver to 16,600 kilos., valued at 1,499,409 florins. The output of lead in Hungary in the year 1890 amounted to 1,067,000 kilos., valued at 188,503 florins; of litharge, 717,900 kilos. were produced, valued at 94,837 florins; of copper, 266,900 kilos., valued at 169,073 florins.

The Russian Petroleum Trade.—According to a recent report of Mr. Chambers, U. S. Consul at Batoum, the production of crude oil in the Baku district during 1890 averaged nearly 80,000 barrels (of 42 gallons each) per day, as against 68,000 barrels daily in 1889. Early in 1891 the output was advanced to as much as 125,000 barrels a day. Last year the high prices greatly stimulated drilling, so that by the end of the year there were 238 wells at work, 130 drilling, 46 cleaning out and drilling deeper, and 79 new derricks up. All these figures are much larger than the corresponding totals for 1889. The aggregate increase in the output of all petroleum products in 1890 over 1889 was 36,342,075 gallons, of which 32,277,235 gallons were exported, the balance going to Russia. Excluding Austria-Hungary and Roumania (for Serbia), the customs tariffs of which countries discriminate against American petroleum in favor of Russian, the increase in exports of Russian in competition with American was 17,512,820 gallons.

SULPHUR.

By W. H. Adams, M. E.

BRIMSTONE.

The amount of brimstone produced by American mines during the year 1891 was only 1,200 tons, all coming from the Cove Creek mines, 22 miles from Beaver, Utah. About 25 men are now employed at the mines, and about 20 tons a day of brimstone are being shipped. It is not to be expected that Utah or Nevada sulphur can be sold in the Eastern states so long as freight rates remain as at present, yet there is no reason why they should not compete with Japan sulphur products and supply the entire Pacific slope at remunerative prices. The possibility of supplying certain trade centers from outlying mining districts depends almost entirely upon freighting facilities, and Japan sulphur, according to a recent consular report, cannot be carried from San Francisco for less than \$16 freight, so that a very small margin is left to the producers after mining and refining costs are discharged. The lowest estimate we have seen for Japan sulphur laid down in California is \$26 per ton, whereas there should be no question of the ability of Utah or Nevada mines to supply any reasonable tonnage at a cost not to exceed \$17 delivered. The production of brimstone and pyrites in the United States is shown in the following table:

PRODUCTION OF BRIMSTONE AND PYRITES IN THE UNITED STATES.

Year.	Brimstone.		Pyrites.		Total Value.
	Amount: short tons.	Value.	Amount: short tons.	Value.	
1882....	600	\$21,000	13,440	\$72,000	\$93,000
1883....	1,000	27,000	28,000	137,500	164,500
1884....	500	12,000	39,200	175,000	187,000
1885....	715	17,875	54,880	220,500	238,375
1886....	2,500	75,000	61,600	220,000	295,000
1887....	3,000	100,000	58,240	210,000	310,000
1888....	.....	.....	60,850	167,658	167,658
1889....	450	7,850	104,950	202,119	209,969
1890....	.....	.....	109,431	244,265	244,265
1891....	1,200	36,000	122,438	122,438	353,280

Progress is noted in operations aimed to open up the great sulphur bed of Louisiana, 230 miles west of New Orleans, on the Southern Pacific Railroad. The sulphur bearing stratum at this location lies about 500 ft. below surface and is shown, by diamond-drill borings, to be of exceptional richness.

The importations of brimstone from Sicily continue on the same generous scale as noted for the past three years, notwithstanding the violent fluctuations in prices over the year as shown by the following table:

IMPORTS OF SULPHUR INTO THE UNITED STATES FROM 1867.

Years.	Crude.		Flowers of sulphur.		Refined.		Total Value.
	Quantity, long tons.	Value.	Quantity, long tons.	Value.	Quantity, long tons.	Value.	
1867	24,544.10	\$320,373	110.05	\$5,509	250.55	\$10,915	\$636,797
1868	18,150.55	446,547	16.48	9,948	61.75	12,721	1,265,588
1869	23,589.69	678,642	96.59	4,576	645.04	27,149	1,293,393
1870	27,379.60	829,677	78.34	3,927	157.24	6,528	1,851,434
1871	36,131.46	1,213,202	65.54	3,514	92.26	4,728	2,250,605
1872	25,379.55	764,798	35.97	1,822	56.94	2,492	1,707,725
1873	45,533.27	1,801,000	55.29	2,824	35.97	1,497	2,882,260
1874	40,939.55	1,360,491	51.08	2,694	56.68	2,403	2,076,691
1875	39,683.10	1,259,472	17.83	891	.....	.....	2,152,919
1876	46,434.72	1,475,250	41.07	2,114	43.87	1,927	2,555,351
1877	42,962.69	1,242,888	116.34	5,873	1,170.80	36,962	1,951,354
1878	48,102.46	1,179,769	158.71	7,628	149.51	5,935	1,851,354
1879	70,370.28	1,575,533	137.60	6,509	68.94	2,392	2,250,605
1880	87,837.25	2,024,121	123.70	5,516	158.36	5,262	2,720,266
1881	105,096.54	2,713,485	97.66	4,236	70.96	2,555	3,296,695
1882	97,504.15	2,627,402	158.91	6,926	58.58	2,196	3,296,695
1883	94,539.75	2,288,946	79.13	3,262	115.33	8,487	2,255,351
1884	105,112.19	2,242,697	178.00	7,869	126.00	4,765	1,951,354
1885	96,839.44	1,941,943	120.56	5,351	114.08	4,060	2,250,605
1886	117,538.35	2,237,989	212.61	8,739	116.05	3,877	1,929,260
1887	96,831.55	1,638,360	273.96	9,880	89.55	2,882	2,076,691
1888	120,104.00	1,927,346	60.00	1,921	.....	3	2,076,691
1889	135,935.00	2,068,208	282.00	8,184	10.00	299	2,152,919
1890	131,086.00	2,147,481	181.02	15,139	\$ 110.33	1,299	.....

* Fiscal years ending June 30th, from 1867 to 1887, inclusive; subsequently, calendar years ending December 31st, unless otherwise specified. † Fiscal years.

This steady consumption is accounted for by the fact that so many new plants for the manufacture of sulphuric acid are being erected in the Southern States and by men who, having no training in the use of pyrites, prefer the good old way of handling brimstone whatever may be the difference in cost.

There is a point, in this choice of methods toward an end, which the newer class of fertilizer manufacturers do not as yet fully understand, and they will no doubt cling to a use of foreign sulphur until competition of the sharpest kind with a lowering of prices of all commodities, compels them to make the change or brimstone producers to lower prices.

The older chemical concerns have been working for years in the same rut, and it may be stated as follows:

COST OF SULPHURIC ACID FROM BRIMSTONE (WORKS BURNING 4 TONS IN 24 HOURS.)	
Four tons brimstone, freights, losses in transit and burning @ \$30.....	\$120.00
Nitrate of soda, 6% of sulphur, 538 lbs. @ \$2.50.....	13.45
Labor, 5 men @ \$1.25 per day.....	6.25
Coal, 2 tons @ \$3 per ton.....	6.00
Superintendent and office cost.....	6.00
Wear and tear.....	10.00
Total cost for 18 tons 48° B. acid.	\$161.70
Or one ton of 48° B. acid costs \$8.98.	

Now, if this acid were to be sold on the market it would bring in Boston, New York, Philadelphia, Baltimore, etc., not to exceed \$8 net at the factory and for large quantities even lower prices. These costs and this

condition of the market have held for years past, and while circumstances may modify them at times yet the facts are that no manufacturer of brimstone acid alone has had a remunerative business for many years.

Why then do we hear of new plants being erected every year, and the older plants still continuing the use of brimstone? The answer for the fertilizer concern will be an answer for all classes of trade. One ton of 48° B. acid costing \$8.98; one ton of ground and dried rock costing \$10; labor and power costing \$2.02; a total of \$21.00, will produce 2 tons acid phosphate which is sold to average in commercial fertilizers for \$50, in other words, so long as the ton of 48° B. sulphuric acid can be put into any condition by mixture or change, whereby it sells for a large advance on its cost there is no incentive for the manufacturer to study differences between brimstone and pyrites as available sources for supply of sulphur.

Causes which we have several times referred to, such as the gradual exhaustion of the sulphur producing territory in Sicily, the lessened percentage of sulphur in the mine products; the increased prices of labor, etc., have combined to lessen the imports for the year 1891, so that an exceptional state of affairs exists at present, viz; brimstone in store commands any price asked from \$30 to \$40, and "Ex ship to arrive January" brings \$29 to \$32 per ton.

PRICES OF BRIMSTONE IN NEW YORK IN 1891. Best unmixd seconds. Thirds from 50c. to \$1 less.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Highest: Spot.....	\$28.00	\$27.00	\$37.00	\$36.00	\$35.00	\$31.00	\$27.00	\$28.00	\$33.00	\$33.00	\$31.50	\$40.00
Futures.....	27.50	28.00	35.00	32.00	32.00	27.50	24.70	27.00	30.00	30.12½	31.00	30.75
Lowest: Spot.....	27.50	27.00	33.00	30.00	30.00	24.00	26.00	30.00	30.00	30.50	31.00	34.00
Futures.....	25.75	27.50	31.00	30.00	26.50	24.50	22.00	24.50	27.50	27.75	28.00	30.00

PYRITES.

We note under this head, only such pyrites as are mined for sulphur contents and utilized in manufacture of sulphuric acid, although it is well known that a very large tonnage of pyrites is produced annually, as concentrates in dressing gold and silver ores, and that the roasting process necessary to free them from sulphur for the after treatment, might be modified or changed to utilize most of the sulphur they contain. We have stated in our annual reports for past years the fact of the general distribution of pyrites over the several sections of the United States, and have published from time to time all the data obtainable to localize values of this now staple commodity. We are constrained to again note the production of pyrites for the year 1891 as limited to two of the Northern States, viz., Massachusetts, 37,320 tons of 2,240 lbs., valued at \$137,280, and Virginia, 72,000 tons, valued at \$216,000 (these figures being partly estimated). This shows, as compared with last year's reports, that these mining sections have been filling regular orders for established trade, within easy transportation reach, and increasing their production only as required by the natural growth of trade in their own territory. As reported to us the actual sales made by these mines will amount to about 120,000 tons, of 2,240 lbs., equivalent to 44% sulphur, or, 52,800 tons pure sulphur produced.

IMPORTS OF PYRITES INTO THE UNITED STATES SINCE 1881.

Year.	Quantity, Long tons.	Average sulphur contents, Per cent.	Year.	Quantity, Long tons.	Average sulphur contents, Per cent.
1882.....	29,818	35	1888.....	81,000	42
1883.....	35,811	36	1889.....	100,000	43
1884.....	44,250	36	1890.....	115,000	43
1885.....	50,000	38	1891.....	130,000	44
1886.....	60,000	38			

We estimate the sulphur consumed in the United States during 1891 as follows: Imports of brimstone, 120,000 tons of 2,240 lbs.; imports of pyrites, 130,000 tons (44% S.) 57,200 tons; product of American mines (120,000 tons, with an average of 44% S.), 52,800 tons. We might give details of this consumption, showing how radically the changes are taking place in manufacture of sulphuric acid, and how surely the tendency is to centralize plants in localities near to phosphatic materials—the increase in production of acids being almost entirely for dissolving the land and river rocks mined in Carolina and Florida. There are 35 acid works in the states south of Maryland, 27 of them built since 1887. It is safe to say that within the coming three years there will be double the acid produced in territory contiguous to the newly discovered Florida phosphate fields, as it would seem as if the solution of the problem of marketing the enormous tonnage sure to be mined from the hard rock and pebble deposits depends upon a manufacture of these phosphates into acid phosphate.

There exists at present a market for about 100,000 tons of Florida phosphate annually. For acid phosphate there are larger demands, and if prices were lowered to fair manufacturing points these probably can be increased.

With this prospect for Southern industries it is reasonable to suppose we shall have new deposits of pyrites developed in the South pending the opening of the Louisiana sulphur beds. This seems more than likely, as freights into the interior of the Southern States have so far been a bar to entrance of foreign ores, and the local mines will therefore always be able to command a certain trade.

This is shown by taking prevailing prices (which are abnormally high, for brimstone), and comparing:

Brimstone, at coast cities, cost.....	\$30.00
Freight to interior factories.....	2.50
Foreign pyrites, basis 48% sulphur, ex-ship 12c.....	\$5.76
Freight to interior cities.....	2.50
Virginia pyrites, at mines.....	\$3.50
Freight to interior cities.....	2.75
	\$6.25

At points where consumed, the prices of sulphur in each of the above sulphur products would be at present:

100 units of sulphur in brimstone.....	\$31.00
100 units of sulphur in foreign pyrites.....	18.15
100 units of sulphur in Virginia pyrites.....	14.50

Owing to the enormous prices charged for brimstone, which went up from a normal price of about \$20 to \$22 a ton to \$35 at which it sold this year, there has been a general inquiry for data bearing upon the subject, and during the year past several of the oldest chemical concerns have changed their plants or added new plants to accommodate themselves to manufacture of sulphuric acid from ores.

This has brought in prominence several entirely new sources for the supply of high grade pyrites ores, notably the Spanish and Newfoundland ores, which have been burned at several works along the Atlantic coast with more or less success during the year 1891.

THE MANUFACTURE OF SULPHURIC ACID; VIEWS OF THE NICHOLS CHEMICAL COMPANY.

During the year 1891 the manufacture of sulphuric acid in this country has undergone what might be termed a revolution. Hitherto, with the exception of a few manufacturers, every one engaged in this industry in the United States has used Sicilian brimstone as a raw material. The few exceptions referred to, like their brethren in England and on the Continent, have depended upon iron or copper pyrites for their sulphur. The great advance in the price of Sicilian brimstone during the year has rendered it absolutely necessary for the manufacturers using that article either to work at a considerable loss, or else to abandon its use and take up that of pyrites.

Of course the quality of the sulphuric acid produced from pyrites depends upon the constituents other than sulphur contained in the ores. Where a large percentage of arsenic is present, an inferior acid is produced, although there are various ways of freeing the article from this impurity. As a rule, however, the acid made from pyrites is of excellent quality, and in some cases is fully equal to that made from brimstone. It is due to American manufacturers to say that they have made some substantial improvements over those abroad, due largely to the purity of the acid required by consumers. The American manufacturer would have difficulty in marketing his products, if they were not purer and less colored than those produced abroad.

At the beginning of the year the price of sulphuric acid was almost at its lowest point; since that time there has been a gradual advance in values, until at the present prices are at the highest point of the years. This is due to the fact that low prices and bitter competition for year had discouraged construction of new works, while at the same time the consumption was growing with the growth of the country. The change from brimstone to pyrites also had its effect, decreasing, as it did, the productive capacity of the plants changed. Prices at the present time, however, are not high enough to encourage the construction of new works, and it is therefore likely that the demand during the coming year will fully equal, if not exceed, the supply. With such a state of affairs existing, it is probable that prices will advance somewhat, and that the coming year will witness a better condition of affairs in the acid market than has been seen for a number of years past. The bitterness which has hitherto existed among manufacturers has to a large extent disappeared and everything points to a bright future.

There have been desultory attempts made to form combinations of manufacturers in various parts of the country, with a view of artificially raising prices. Considering the amount invested in plant, and the skill required in its management, there are probably few industries that yield smaller returns than the manufacture of sulphuric acid. It is not likely, however, that any combination to advance prices artificially will become operative. The industry is on a much more secure foundation than that.

TIN.

THE TIN MARKET IN 1891.

Again during the year was a good deal heard about the production of tin on this continent, but, as in previous years, most of it was on paper. A few weeks ago a shipment of tin was advised from Durango, Mexico, as having been shipped to Pittsburg, but as far as we can ascertain the supplies in the former place are quite irregular and can not yet be counted upon. The Harney Peak tin mines have also, as usual, been heard of at intervals, and promises for a prosperous future are still held out. The only mines which have so far actually produced tin are the Temescal, in Lower California, but the quantity has been small, the company having been greatly hampered by internal difficulties, change of management, etc. It is confidently hoped that 1892 will see a much larger production, though it cannot be of such proportions as would influence the markets of this country, much less those of the world. In the meantime, the duty of 4c. a pound on tin will become operative on July 1st, 1893, unless Congress should enact a different law.

Fluctuations in price during the year were comparatively small, and this in spite of consumption being quite equal to that of the previous year, and imports not being excessive, besides the fact that during the larger part of the year the metal ruled at a very low figure; but the conditions of trade in general, as related in our report on copper, could not fail to influence tin also, and in spite of the cheapness of the metal there was no speculation to influence the value and bring about artificial fluctuations.

The market early in January was 20c., and with but slight changes that figure ruled steadily up to March, when a better tendency prevailed, and prices rose to about 20½@20¾c., but that was not of long duration, and with a weaker tendency in Europe values soon gave way, and a heavy decline setting in, prices receded to 19½@19¾c. by the end of April. At those figures there was very heavy buying by consumers, and, spot stocks becoming scarce, prices quickly advanced to 20¾c. by the middle of May and a good business was done. After that prices sagged off somewhat, only to advance in the beginning of June to about 20¾c., but that point was not long held, and the middle of July saw prices at about 20c., and at about that figure they ruled during the rest of the year, the variation being not greater than ½ or say from 19¾c. to 20¾c. At such prices the importers were of course laboring under very adverse conditions, and if they did not lose money they certainly were not able to make any. The close of the year comes with stocks light, and consumers not at all covered ahead, so it is to be hoped that ere long things will so change that consumers will not be the only ones to be benefited.

PRICES OF STRAITS TIN IN NEW YORK.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1885.	16½	17-45	17½	17-0	18½	20½	22½	21½	20-05	20-95	20-95	21	19½
1886.	20-4	20-70	20-50	20-8	21-0	22½	22½	21½	22-20	22½	22-40	22½	21-65
1887.	20-30	22½	22-55	22½	22-9	23½	23-15	23-0	24½	25½	31-05	36½	24-85
1888.	36-95	36-95	31-70	32-45	21-9	18-05	19½	20½	22-95	21-45	22-0	22-0	36-20
1889.	21½	21½	21-0	20¾	20½	20-30	19½	20-20	21-30	20-80	21½	21-0	21-80
1890.	20-95	20-87	20-39	20-13	21-52	21-53	21-17	21-62	24-00	22-60	21-07	21-24	21-42

IMPORTS OF TIN AND TIN-PLATE INTO THE UNITED STATES.

*Year.	In blocks, bars, or pigs, and grain tin.		Tin plates, sheets, etc.		Total value.
	Quantity.	Value.	Quantity.	Value.	
	Cwts.	\$	Cwts.	\$	
1867.		\$1,210,354.02		\$6,276,136.78	\$7,486,490.80
1868.		1,454,327.36		6,893,072.07	8,347,399.43
1869.	89,811	1,709,385.00	1,574,324	8,565,422.50	10,274,817.56
1870.	81,762	2,042,887.71	1,333,150	7,628,871.51	9,671,759.22
1871.	106,595	2,938,409.82	1,556,023	9,490,778.64	12,429,188.46
1872.	102,006	3,033,837.45	1,617,627	10,736,906.59	13,770,744.04
1873.	130,469	3,938,032.23	1,854,956	15,906,446.82	19,844,479.07
1874.	116,42	3,199,807.67	1,553,860	13,322,976.14	16,522,783.21
1875.	102,904	2,329,487.96	1,540,600	12,557,630.75	14,887,118.71
1876.	93,176	1,816,506.00	1,767,210	10,226,892.87	12,043,398.87
1877.	98,209	1,783,765.00	1,984,893	9,818,069.69	11,601,834.69
1878.	128,849	2,167,356.00	2,166,489	9,893,639.61	12,060,995.61
1879.	142,927	2,301,944.00	2,487,007	10,248,720.34	12,550,664.34
1880.	29,007	6,153,005.8	3,298,534	16,524,590.19	22,677,595.87
1881.	171,146	3,971,756.87	3,366,720	14,611,057.87	18,582,814.74
1882.	197,544	3,704,251.88	3,920,911	16,550,834.64	21,755,086.52
1883.	237,348	6,106,250.37	4,051,108	16,688,276.07	22,794,526.44
1884.	(a) 26,681,992	5,429,184.01	(a) 527,881,321	18,931,072.70	24,360,256.71
1885.	23,947,523	4,263,447.00	505,559,076	16,610,104.36	20,873,552.00
1886.	27,960,761	5,873,773.01	574,098,405	17,719,957.12	23,593,730.12
1887.	29,645,531	6,927,710.00	570,643,389	15,883,813.95	23,511,523.95
1888.	31,740,583	8,758,562.00	632,224,296	19,034,821.03	27,793,383.03
1889.	35,177,646	7,045,939.00	734,086,964	20,361,564.00	27,107,503.00
1890.	33,840,729	6,869,645.00	688,247,657	21,923,754.00	28,793,390.00

* Fiscal years ending June 30th until 1885; calendar years since that date. (a) Pounds in 1884 and following years.

THE CALIFORNIA TIN MINES.

(From our Special Correspondent.)

The San Jacinto Estate (Limited) has become a regular producer of tin during 1891, and work at the mine is now progressing steadily and satisfactorily. The outlook now is somewhat different from what it was a year ago, when everything was in an experimental stage. Within the year the necessary machinery has been placed in position, and the development of the Cajalco vein extended quite materially. To be sure numerous difficulties and stoppages have occurred, but these, if not satisfactorily overcome, have at least been reduced to a great extent. The principal trouble seems to have occurred in the control of the petroleum steam blast in the furnaces, which has proved damaging to the fire bricks, necessitating their frequent renewal. The output of pig tin during the last part of the year has been reduced somewhat, owing to the reconstruction of the reverberatory furnace.

The output of the company during the year is shown by the following figures, for which I am indebted to the kindness of Messrs. W. W. Stewart & Co., of San Diego, who are the sole agents for the product of the Cajalco mines. The shipments of tin commenced in June last, during which month 11,820 lbs. of pig tin were consigned to Stewart & Co. The second shipment consisted of 8,180 lbs., arriving the latter part of June or early in July. The third shipment weighed 14,071 lbs., which was received in August. In the month of September 13,000 lbs. came down from the mine, followed in October by 17,875 lbs. The November shipment was somewhat less than that of the previous month, weighing 15,420 lbs. On December 22d a lot of 26,000 lbs. was received. The product for the remainder of the month may be safely placed at 5,000 lbs. It will be seen by these figures that 106,366 lbs. of pig tin produced from ore from the Cajalco mine, have passed through the hands of Stewart & Co., who have readily placed every pound of it at the ruling market price. The gross value of the metal is placed nominally at 20 cents at the mine. In addition to shipments above given, a quantity was sent directly from Cajalco to San Francisco, amounting to about 12,000 lbs., which was also marketed by Stewart & Co. The product of tin in 1891 may therefore be placed at approximately 1,336,666 lbs., having a gross value of \$24,673.

THE LONDON TIN MARKET IN 1891.

(From our Special Correspondent.)

The new year opened with this article in upward tendency, to which the good statistics for December, showing a decrease of 800 tons in the visible supply, may have contributed slightly. The spot rate during the first fortnight of January from £90 5s. to £92 for price Straits, following which there came a decided reversal of tendency; the shipments from the Straits were anticipated to be extensive and resulted, in fact (in conjunction with the other usual factors of supply and delivery), in an increase of about 1,700 tons for the month, while the easier money market, with the reduction in bank rate to 3½%, failed to infuse any animation into the speculative spirit or to counteract the effect of adverse factors. The month closed with spot at £90 10s.

February began with a continuation of the downward movement alluded to above, £89 7s. 6d. being accepted for s. c. Straits. Subsequent variations ranged between this, the lowest limit, and £90 15s. The business done was very considerable, good quantities being booked for America, for direct shipment from the Straits, and deliveries were also heavy. The final statistics for the month showed a slight improvement, notwithstanding the again large shipments from the East.

March was free from any important fluctuations in value, £89 15s. to £90 10s. forming the extreme range. Supplies were again heavy, but so also were deliveries, the tin plate trade being distinguished by extraordi-

mary vigor, due to the great demand in view of the increased duty to come into force in America on July 1.

The last value named, £90 10s., was maintained, with only slight variations, during the first half of the month of April, but was subsequently depressed by sales and receded to £89 2s. 6d.

May, notwithstanding greater stringency in the money market, developed considerable speculative activity, the constant decline in the spot stock of tin in London, notwithstanding the large shipments from the East, no doubt attracting the interest of speculators.

The early days of June witnessed the development of the above named advance, and up to £94 10s. was paid for cash. This level was not, however, maintained and in spite of three successive reductions in the bank rate the month closed dull at £91 17s. 6d.

August was, as far as speculation is concerned, a quiet month, with values varying steadily between £90 15s. and £92 5s. and closing at £91 10s.

September brought with it no noteworthy change of any description, consumption continuing on a satisfactory footing, while values were again subject to only slight oscillations, viz., between £91 and £92 5s.

October's speculative market was comparatively inanimate and the net result of the month's operations was a decline in values from £92 to £89 5s., due in part to the inability of a firm of metal brokers to meet their engagements.

November was characterized by rather more life in speculative inquiry and by a continuance of the good demand for consumers. Supplies, especially for early delivery, were on the other hand scarce.

The following figures show the supply of tin in Europe and America for the twelve months ending December 1st, 1891:

Table showing supply of tin in Europe and America for the twelve months ending December 1st, 1891. Columns include year (1891), tons, and prices of spot Straits.

ZINC.

Of the metals produced in this country none has shown a more rapid proportional increase in output than zinc, and this in the face of constantly declining prices.

In 1891 the production of spelter was 76,500 tons of 2,000 lbs., an increase of nearly 11,500 tons over the output in 1890 (66,342 tons) as given in the revised statistics which we have collected.

The several producers of zinc have, at our request, politely corrected their returns of production for 1890, published in this paper a year ago, and which were necessarily estimated in part for the month of December.

In our work of getting the figures of output for 1891, we have been obliged to estimate, in part, the output of three producers, which we have done as follows:

Table listing three zinc producers: The Lehigh Zinc and Iron Company, The Passaic Zinc Company, and The New Jersey Zinc and Iron Company, with their respective tons and values.

These figures are a slight increase on the output of these companies in 1890. Every other producer courteously co-operated in our arduous effort to collect full and reliable statistics of the mineral industry for the benefit of the whole world.

We have this year allotted the output to the States in which the ores were treated instead of to those in which they were mined. The great difficulty, not to say impossibility, of tracing all the ore back to the mines, rendered the figures in some cases misleading.

The demand for spelter during the year has been so active that the increased output was absorbed as quickly as produced, and the stocks of

metal on hand at the close of the year, which have been returned to us by each of the producers (with the exceptions above mentioned) are scarcely sufficient to supply the consumptive demand for a single week.

SPELTER PRODUCTION OF THE UNITED STATES.

Table showing spelter production of the United States by state for 1890 and 1891. States include Illinois, Kansas, Missouri, and Eastern & Southern.

IMPORTS AND EXPORTS OF ZINC.

Large table showing imports and exports of zinc by year (1886-1891), categorized by blocks or pigs, sheets, and total value. Includes sub-categories for ore or oxide and plates, sheets, pigs or bars.

* Calendar years ending December 31st from 1886; previous years end June 30th. † Including value of manufactures of zinc.

PRODUCTION OF SPELTER IN EUROPE AND UNITED STATES IN 1889 AND 1890.† [In English Tons.]

Table showing production of spelter in Europe and United States in 1889 and 1890. Includes sections for United States, Poland, Rhine District and Belgium, Silesia, France and Spain, Austria, and Great Britain.

* Compiled by Henry H. Merton & Co

* Estimated.

THE WORLD'S PRODUCTION OF ZINC, IN TONS OF 2,240 LBS.

	United States.	Belgium.	Silesia.	Great Britain.	France & Spain.	Poland.	Austria.	Total:
1880.....	20,749	98,830	64,450	*22,000	15,000	*4,000	*2,520	227,558
1881.....	30,000	110,989	68,497	24,419	*18,358	*4,000	4,270	258,533
1882.....	30,148	119,193	68,811	25,581	18,075	4,400	5,094	271,302
1883.....	32,921	123,891	70,405	28,661	14,671	3,733	4,672	278,954
1884.....	34,414	130,522	76,116	29,259	15,341	4,164	4,470	294,286
1885.....	36,339	129,754	79,623	23,099	14,847	5,019	3,890	292,571
1886.....	38,072	129,020	81,630	20,730	15,305	4,145	3,760	292,662
1887.....	44,947	130,995	81,375	19,319	16,028	3,580	3,566	299,810
1888.....	49,922	133,245	83,375	26,633	16,140	3,785	3,827	316,927
1889.....	52,812	134,645	85,653	30,806	16,785	3,025	6,500	329,880
1890.....	63,020	137,630	87,475	29,145	18,240	3,620	7,135	341,265

THE SPELTER MARKET IN 1891.

The bright prospects with which the year opened have been only partly fulfilled. There has been another rather heavy increase in production, which proved to be larger than the demand, and in consequence prices have quite seriously declined. During nearly all the year there was a tendency on the part of the producers to sell the metal as fast as it could be produced; on the other hand, a great shyness on the part of consumers to take in more than their actual wants, when they found that the prices were continually declining. The galvanizing trade was rather bad during the year. It looked in the spring as if business would pick up, but these expectations were not realized, and although the brass trade took fair quantities, they were not sufficiently large to make up for the largely increasing production. The exceptionally mild winter of 1890-91 greatly favored the working of the ore deposits of Southwestern Missouri and South-eastern Kansas, and this put a much larger quantity of raw material into the hands of Western smelters than they had anticipated; so ores, of course, declined in value, quite materially, early in the year. New works were started in Pittsburg, Kan.; others increased their output not inconsiderably, and had it not been that the European market was rather high, and admitted of exporting from here, prices would no doubt have gone down still more, as the pressure to sell was great.

January opened with spelter quoted at \$5.75c. in New York, but a sharp decline took place, and in the beginning of February 5 to 5½c. was reached, and these prices continued, with moderate fluctuations, until the middle of April, when the 5c. line was crossed. In the beginning of March a few thousand tons of ores were shipped to Swansea, but even that could not save the market, and during April and May frequent sales were made at 4.95 to 4.90c., and even, in isolated cases, at 4.85c. In June the tendency was somewhat harder, several export orders being in the market; and that being the best time for consumption, prices advanced, and during June and July ranged from 5.10 to 5.15c., but very soon, under heavy selling, gave way to easier prices. During August 5c. was accepted, at which price, although prices temporarily declined to 4.95c., the market ruled steady until about the beginning of November, when a further break in prices occurred. By that time ocean freights had advanced so much, and the foreign markets had given way so that the foreign demand ceased. This market being thus left to itself, values came down to the very low point of 4.75 to 4.80c. New York, at which they closed. Even at these low figures sales have been made for some time ahead, partly for six months and partly for somewhat longer, and as supplies of ores continue plentiful and fairly cheap, the tendency to increase the output continues, and we dare not look too sanguinely into the future. All, of course, depends on the consumption, and should the galvanizing trade be much better next year, prices may harden; but unless this is the case, it would not be safe to predict higher levels for some time yet.

AVERAGE MONTHLY PRICES OF SPELTER IN NEW YORK, IN CENTS PER POUND.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1875..	6.56	6.46	6.35	6.75	7.20	7.20	7.30	7.17½	7.17½	7.27½	7.27½	7.27½	7.00
1876..	7.50	7.62½	7.68½	7.80	7.87½	7.62½	7.18½	7.12½	6.96	6.68½	6.49½	6.43½	7.25
1877..	6.37½	6.56	6.43½	6.31	6.12½	6.43½	5.99½	5.74½	5.85	5.81	5.80	5.74½	6.03
1878..	5.62½	5.43½	5.43½	5.12½	4.81	4.43½	4.62½	4.68½	4.81	4.69	4.62½	4.31	4.88
1879..	4.37½	4.51	4.49½	4.50	4.37½	4.24½	4.56	5.21	5.81	6.18½	6.06	6.12½	5.69½
1880..	6.18½	6.56	6.62½	6.31	5.81	5.31	4.93½	5.06	4.93½	4.93½	4.77½	4.70	5.51
1881..	5.06	5.18½	4.93½	4.93½	5.33½	4.87½	4.87½	5.06	5.12½	5.31	5.68½	5.93½	5.24½
1882..	5.87½	5.68½	5.49½	5.37½	5.43½	5.31	5.24½	5.31	5.24½	4.90½	4.90½	4.68½	5.32½
1883..	4.56	4.56	4.68½	4.67½	4.62½	4.49½	4.40	4.35	4.45	4.40	4.38½	4.36	4.49½
1884..	4.28½	4.32½	4.50	4.57½	4.52½	4.50	4.57	4.56	4.47½	4.35	4.12½	4.44½	4.44½
1885..	4.31	4.27½	4.21	4.21	4.17½	4.05	4.25	4.50	4.56	4.56	4.52½	4.52½	4.34½
1886..	4.40	4.42½	4.55	4.55	4.50	4.37½	4.35	4.35	4.32½	4.27½	4.27½	4.42½	4.40
1887..	4.55	4.55	4.47½	4.45	4.55	4.55	4.57½	4.55	4.50	4.52½	4.77½	4.50	4.62½
1888..	5.42½	5.35	5.10	4.85	4.65	4.55	4.55	4.75	4.97½	5.05	4.90	4.87½	4.91
1889..	5.00	4.95	4.75	4.67½	4.75	4.97½	5.10	5.20	5.17½	5.10	5.20	5.40	5.02½
1890..	5.41	5.28	5.18½	5.18½	5.35	5.57	5.55	5.27½	5.6	6.01½	5.12½	5.13	5.53
1891..	5.55	5.02½	5.12½	5.00	4.85	5.08½	5.08½	5.01	4.95½	5.02	4.83	4.75	5.02

THE LONDON SPELTER MARKET IN 1891.

(From our Special Correspondent.)

This article, which during the last quarter of 1890 declined from £25 5s. to £23, began the new year under unfavorable auspices, one of its chief supports, viz., the galvanized iron trade, being in a depressed condition, and the only demand being quite small and emanating almost entirely from dealers. The value consequently declined to £22 10s., after which, the severity of the frost impeding transport, there came a bit of a squeeze for spot stuff and a rise to £23 5s. In an isolated case even £24 was paid for a spot parcel.

During February the market remained steady and pretty firm, sustained by some demand from the Midlands, and also by the strong tone on the Continent. Prices ranged from £23 7s. 6d. to £23 15s.

March was characterized by very poor demand, the home sheet zinc trade and export galvanizing continuing to be unsatisfactory, although the home galvanizing branch was slightly better. The value accordingly

receded to £23 ex-ship during this month; and in April, when the apathy of all branches was, if anything, intensified, we went still farther back, £22 12s. 6d. being accepted at the close. After £22 8s. 9d. had been done, early in May, an improved inquiry, combined with the report of a somewhat better state of things in galvanizing, brought about an advance to £22 17s. 6d. The larger galvanizers, however, denied that there was any substantial improvement in their trade, and although the shipments of galvanized iron during the first four months of this year exceeded those of the same period of 1890 by 17,000 tons, it must be remembered that 1890 was exceptionally bad, and that a good share of these shipments may have been ex-stock. About one fact there seems to have been common agreement, and that is that the prices obtainable for a long time past had been, and were still, at ruinous level. One branch, however, viz., netting, seems to have been quite good throughout the year, and was just now particularly busy. Australia and India inquired more freely in June for galvanized iron, and a firmer tone set in, accompanied by a rise in value to £23 15s. South America, too, was in the market, but sellers, taught by painful experience, fought shy of her inquiries.

A transitory relapse in July to £23 12s. 6d. was succeeded by a stronger feeling and a rally to £23 18s. 9d. The month closed, however, quiet again, with demand on a very reduced scale, but with very little offering, English stocks being light, and also those on the Continent. August passed away under unchanged conditions, and closed with ordinaries at £23 7s. 6d.

In September moderate purchases by consumers and dealers strengthened the tone of the market and up to £23 16s. 3d. was paid. Galvanized iron was 5 shillings better and there was also improvement in manufactured iron and pigs. October opened in quiet tendency and down to £23 7s. 6d. was accepted. The Belgian and Silesian smelters definitely agreed to prolong their convention to the end of 1894, with option to increase the total production by 7,000 tons per year. It is however doubtful whether this option will be exercised to the full, especially during next year. In November, the Silesians renewed their understanding for a minimum price—fixed at £22 10s. Breslau, for the first six months of 1892. Our market in September, after opening with sellers for December at £23 5s., gradually fell away, the competition of American spelter being one of the factors in the decline, and when December opened we had reached £22 5s. ex-ship.

We may here remark that the demand for sheet zinc on the Continent this year has been so good that the falling off in the consumption of spelter in England for galvanizing has been counterbalanced, so that the year has practically been one of very moderate or no stocks at all. In view, however, of the heavy losses made on the Continent recently, it is not likely that building will be very brisk next year, and we shall probably see a less active demand for sheet zinc in consequence. At the same time (as indicated above) Continental makers have arranged to slightly increase their output, and added to this there is the new feature of increasing supplies from the United States, which have been going steadily on for the past few months, and seem likely to continue. All these circumstances combined make the outlook seem less hopeful as far as prices are concerned, and it is therefore quite possible that the price-level next year will be lower than this year.

During the few days preceding the close of our report a rally from the price above named was caused by the disappearance from the market of most of the small parcels which had been pressing upon it, and a little demand confronting limited offerings, we close with buyers at £22 10s. ex-ship.

	1891.	1890.	1889.
Imports (raw spelter) tons.....	53,556	51,678	50,147
Exports (raw and manufactured) tons....	4,870	7,491	6,234

Production of Gold and Silver in Japan.—There is no official record in existence of the output of the Sado mines, the most productive gold and silver mines in Japan, for the whole time during which they have been worked, but, according to a Japanese contemporary, they have turned out in 276 years 1,290,348,74 oz. of gold and 62,078,216.38 oz. of silver. From the first year of Meiji to March of 1889, a period of 21 years and 3 months, the total output was 51,494,577 oz. of gold, and 1,500,106.01 oz. of silver. The mines were owned by the Government till a few years ago, when they were transferred to the Imperial House.

The Mineral Production of Austria in 1890.—The figures relating to the production of the mines of Austria (not including Hungary), recently published by the Austrian Ministry of Agriculture in its *Jahrbuch* for 1890, show that the total value of the mine products for 1890 was 68,167,000 fl. (the florin is equivalent to 48.2 cents) and of smelting products 36,889,000 fl. The total value of Austria's mining and smelting produce, after deducting the value of the ores sent to the smelting houses, was 90,716,000 fl. The values of the various mining products were as follows: Coals, 30,401,078 fl.; peat, 27,639,115 fl.; silver ore, 3,167,179 fl.; iron ore, 3,105,765 fl.; lead ore, 969,622 fl.; quicksilver ore, 891,687 fl.; graphite, 726,036 fl.; zinc ore, 568,812 fl.; copper ore, 343,422 fl.; sulphur ore, alum and vitriol shale, 100,261 fl., and other ores, 254,166 fl. The values of the smelting products were as follows: Pig iron, 27,310,617 fl.; silver, 3,257,927 fl.; lead and litharge, 1,686,049 fl.; quicksilver, 1,596,562 fl.; zinc, 1,467,932 fl.; copper, 602,163 fl.; sulphuric acid, 441,947 fl.; copperas and alum, 140,616 fl.; other metals and smelting products, 374,836 fl. In addition there are the products of the salt industry, the total estimated value of which was 23,040,406 fl., showing an increase on the previous year to the extent of 1,464,551 fl. Compared with the year 1889 there was an increase of 9.2 millions of florins, or 15.65% in the total value of the mining products, the figures of 1890 and 1889 being roughly, 68.16 millions and 58.96 millions of florins respectively. Comparing the total values of the smelting products for 1890 and 1889 the figures are, roughly, 36.89 and 32.75 millions of florins respectively, showing an increase in 1890 of 4.14 millions of florins, or 12.64%. The value of the mining and smelting products together was, as already stated, in 1890, 90.7 millions of florins, which, compared with the preceding year, shows an increase of 11.9 millions of florins, or 15.1%.

MINERAL PRODUCTION OF THE UNITED STATES, 1882 TO 1887. (From "Mineral Resources of the United States.")

Main table showing mineral production from 1882 to 1887. Columns include Year, Quantity, and Value in Dollars. Rows list various metals like Pig-iron, Silver, Gold, Copper, Lead, Zinc, etc., and non-metallic products like Bituminous coal, Petroleum, Building stone, etc.

Summary table for 1888, 1889, and 1890. It includes a detailed list of metallic and non-metallic products with their respective quantities and values. A separate section on the right provides a 'Total value of non-metallic mineral products' and 'Total value of metallic products' for each year, along with a 'Grand total'.

Value of the crude products not reported. Including fire clay, common brick, flux, terra cotta, building sand, glass sand, limestone used as flux in lead smelting and glass making, iron ore used as flux and lead smelting, tin ore, iridiansine, stone, nitrate of soda, carbonate of soda, sulphate of soda, native alum, mineral soap, stron ia and pumice stone.

Production of Nickel and Cobalt in Norway. - According to a Government report recently issued the quantity of nickel ore raised in Norway in 1889 was 4,283 tons, from which 93 tons of pure nickel were obtained. During the following year 66 tons of pure nickel were produced from 5,459 tons of ore, while in the year 1889, 7,099 tons of ore produced 68 tons of pure metal. Of this quantity the Ringerikes nickel mines produced 2,712 tons; the Evje mines, 2,612 tons; and the Vierdalen mines 1,765 tons. Of cobalt production the Modum Works in 1887 turned out 4,500 kilos; in 1888, 6,200 kilos., and in 1889, 3,700 kilos.

Mineral Production of Sweden in 1890. - The production of pig iron in Sweden in 1890, according to an official report recently issued, was 456,100 tons, while the output of steel was 169,283 tons. There were 1,457 tons of gold ore produced from 17 mines; 14,985 tons of silver and lead ore from 33 mines; 20,670 tons of copper ore from 16 mines; 615 tons of nickel ore from one mine; 61,843 tons of zinc ore from 45 mines; 10,698 tons of manganese ore from 12 mines, and 1,134 tons of pyrites from one mine. The pure metals produced from the same in 1890 and 1889 were as follows, those for the latter year being given in parentheses: Gold, 175 lbs. (147 lbs.); silver, 2,958 lbs. (2,170 lbs.); copper, 616 tons (580 tons); brass, 282 tons (330 tons); nickel, 8 tons (41 ton-); lead, 456 tons (480 tons). As regards the Swedish coal industry in 1890, 2,343,895 hectolitres of anthracite coal were raised from the Scania coal fields, 850,000 hectolitres being best quality. The output during the five years 1886-90 was as follows: 1886, 2,129,117; 1887, 2,112,708; 1888, 2,112,570; 1889, 2,333,982; and 1890, 2,343,895 hectolitres. However, these coals are of no value in the iron industry, the fields being too far distant and the coals unsuitable for the smelting of iron; but they are used with great advantage on the railways in the south of Sweden.

IMPORTS AND EXPORTS OF MINERAL PRODUCTS FOR TEN MONTHS ENDING OCTOBER 31ST, 1890 AND 1891.

Extract from Report by the Bureau of Statistics.

IMPORTS TEN MONTHS ENDING OCTOBER 31ST.

	Quantity.		Value.	
	1890.	1891.	1890.	1891.
Asphaltum, or bitumen, crude, tons.....	57,673	87,873	\$19,070	\$239,891
Mineral waters all not artificial, galls.....	2,289,602	1,479,109	423,144	293,449
Chlorate of potash, lbs.....	(a) 341,920	2,591,633	33,580	247,900
Muriate of potash, lbs.....	45,879,477	63,304,088	702,034	991,708
Nitrate of potash, crude, lbs.....	12,322,614	13,89,677	361,670	417,163
Other potassium salts, lbs.....	(a) 654,592	11,240,212	24,850	366,104
Nitrate of soda, tons.....	91,867	89,665	2,691,707	2,341,516
Sulphur and brimstone, crude, tons.....	113,287	103,613	1,792,247	2,362,950
Diamonds and other precious stones, rough or uncut.....	.....	.....	338,831	733,822
Guano, tons.....	4,087	11,762	51,195	195,908
Phosphates, crude or native, tons.....	25,110	22,687	183,677	159,189
Other fertilizers.....	.....	.....	621,731	843,979
Manufactures of iron and steel, n. e. s.....	.....	.....	(a) 22,412	272,437
Ores, gold bearing.....	.....	.....	122,768	215,970
Ores, silver bearing.....	.....	.....	7,197,382	8,197,266
Platinum, unmanufactured, lbs.....	4,907	4,649	806,340	594,242
Plumbago, tons.....	11,024	8,075	51,181	412,692
Tin, in bars, blocks, pigs, or grain or granulated, lbs.....	29,734,675	34,202,738	6,005,573	6,726,030
Brass, and manufactures of.....	.....	.....	170,136	245,808
Cement, lbs.....	854,166,625	1,601,708,795	2,535,762	3,764,476
Coal, in colors and dyestuffs, lbs.....	.....	.....	1,533,117	1,289,095
Bicarbonate of soda, lbs.....	797,155	1,190,148	14,304	20,617
Caustic soda, lbs.....	73,377,959	56,586,958	1,516,414	1,110,867
Sal soda and soda ash, lbs.....	294,093,939	276,697,309	3,403,004	3,567,579
Other s lts of soda, n. e. s, lbs.....	18,872,858	13,658,853	110,946	94,234
Clays or earths, tons.....	47,001	50,850	318,879	374,408
Coal, bituminous, tons.....	6,631,212	1,084,896	2,243,783	3,673,428
Copper ore (fine copper contained therein), lbs.....	4,656,859	10,381,651	303,343	772,634
Copper, in pigs, bars, ingots, old and other unmanufactured, lbs.....	4,4716	2,897,334	30,355	257,691
Manufactures of copper.....	.....	.....	90,616	96,768
Iron ore, tons.....	1,099,000	777,183	2,374,043	2,073,246
Pig iron, tons.....	115,029	46,461	3,314,227	993,412
Scrap iron and steel, tons.....	42,743	133,524	645,660	163,616
Bar iron, lbs.....	17,006,849	30,645,201	86,378	587,111
Bars of iron or steel, railway, tons.....	204	233	5,055	7,646
Cotton ties, or baling hoops, lbs.....	33,759,982	.....	520,641	.....
Hoop, band, or scroll iron or steel, lbs.....	13,533,092	1,613,371	341,133	36,600
Ingots, blooms and billets of iron or steel, lbs.....	54,061,881	67,374,163	1,320,910	1,143,051
Sheet, plate and taggers, iron or steel, lbs.....	16,216,376	21,443,808	565,975	593,877
Tin plates,terne plates and taggers, tin, lbs.....	614,729,703	697,737,207	19,436,503	24,785,882
Wire rods of iron or steel, lbs.....	108,908,878	87,936,631	2,145,702	1,613,104
Wire and wire rope, lbs.....	8,571,375	8,511,785	74,840	199,383
Manufactures of iron and steel, n. e. s.....	.....	.....	11,672,544	10,097,476
Precious stones, n. e. s.....	.....	.....	877,365	2,432,039
Lead, and manufactures of.....	.....	.....	4,448,323	6,444,296
Metals and manufactures of, n. e. s.....	.....	.....	483,423	136,483
Marble and stone, and manufactures of.....	.....	.....	87,900	148,801
Mineral substances, n. e. s.....	.....	.....	88,265	46,688
Mineral oils, galls.....	493,363	1,055,973	88,265	46,688
Salt, lbs.....	437,345,450	382,275,674	7,558,800	657,738
Zinc, in blocks or pig, and old, lbs.....	1,889,090	702,270	95,142	35,627
Zinc, manufactures of.....	.....	.....	50,446	15,712

(a) From Oct 6.

EXPORTS TEN MONTHS ENDING OCTOBER 31ST, 1891.

	Quantity.		Value.	
	1890.	1891.	1890.	1891.
Brass, and manufactures of.....	.....	.....	\$352,240	\$389,109
Bricks, building.....	5,621	3,852	53,303	9,180
Bricks, fire.....	.....	.....	44,963	37,015
Coal, anthracite, tons.....	702,522	796,169	2,878,646	3,311,148
Coal, bituminous, tons.....	1,100,600	1,337,684	3,103,380	4,224,215
Copper ore, tons.....	17,793	31,132	3,090,686	8,857,654
Copper ingots, bars and old, lbs.....	7,949,076	60,975,618	199,770	7,821,116
Copper, all other manufactures of.....	.....	.....	129,256	207,866
Fertilizers, tons.....	217,778	180,391	1,604,309	1,997,402
Gunpowder, lbs.....	327,403	710,614	53,441	80,469
All other explosives.....	.....	.....	600,640	777,543
Pig iron, tons.....	14,769	11,532	231,791	203,818
Band, hoop and scroll iron, lbs.....	12,134	325,030	475	8,568
Bar iron, lbs.....	2,046,617	2,695,138	83,736	76,994
Car wheels, No.....	9,818	12,413	79,440	101,268
Castings, n. e. s.....	.....	.....	743,158	703,666
Ingots, bars and rods of steel, lbs.....	283,874	1,131,658	16,678	33,643
Machinery, n. e. s.....	.....	.....	7,565,489	8,273,697
Cut nails and spikes, lbs.....	11,074,350	8,347,675	272,280	206,852
Nails and spikes, all others, including tacks, lbs.....	1,556,671	1,516,710	125,454	114,513
Plates and sheets, iron, lbs.....	1,001,959	712,537	41,882	27,664
Plates and sheets, steel, lbs.....	445,118	233,958	13,652	7,424
Railroad bars or rails, iron, tons.....	56	160	1,136	3,358
..... steel, tons.....	16,035	10,349	538,991	333,459
Wire, lbs.....	19,150,885	23,092,647	767,444	777,278
All other manufactures of iron and steel.....	.....	.....	2,469,782	3,469,782
Lead, and manufactures of.....	.....	.....	138,923	116,209
Lime and cement, bbls.....	67,929	73,775	120,640	113,671
Marble and stone, unmanufactured.....	.....	.....	190,647	140,672
Roofing slate.....	.....	.....	108,885	61,824
All other stone.....	.....	.....	499,681	401,301
Mineral oils, crude, galls.....	81,534,702	75,591,591	5,529,256	4,318,202
Naphtha, galls.....	10,275,964	8,917,946	862,110	691,987
Illuminating oils, galls.....	4,120,040	442,150,455	33,308,336	29,587,545
Lubricating oils, galls.....	25,576,375	27,166,274	3,899,840	4,053,889
Iresidium oil, bbls.....	41,610	23,227	88,256	58,225
Ore, gold and silver bearing.....	.....	.....	1,995,873	20,423
Quicksilver, lbs.....	151,307	273,143	88,969	139,452
Tin, manufactures of.....	.....	.....	223,392	210,628
Zinc ore or oxide, tons.....	2,504	5,391	162,355	126,697
Zinc, pigs, bars, plates and sheets, lbs.....	3,004,206	3,278,352	108,540	204,880
Zinc, all other manufactures of.....	.....	.....	18,017	27,411

SOME NEW APPLIANCES IN MACHINERY FOR MINES.

By William L. Saunders, C. E.

The past year has been one of special activity in the experimental use of new machinery for mines. While it cannot be doubted that something has been accomplished, yet little has been done that may be called conclusive.

Electricity is a success when used for the transmission of power within reasonable distances. Compared with other means by which power is transmitted, it has many advantages which are sure to give it a prominent place as an economical agent. There are many mines located in inaccessible places where fuel is hard to get, and where electricity may be transmitted to better advantage than any other power. Having power in

the shape of electricity at the shaft of a mine, it has been found to be an easy matter to apply it to the hoisting engine, the pump, the tram car, and the ventilating fan. In fact, it has not only been proved practical, but it is in accordance with the best theories that it is simply a matter of proper mechanical application to convert electric power into work through any engine which does work through the revolution of a shaft as distinguished from the percussive action.

Take, for instance, the application of electricity to coal mining. The Jeffrey Electric Company, of Columbus, O., has built coal mining machines for a number of years, the principle of the machine being the revolution of a cutter-bar. A pair of reciprocating engines used for the purpose of revolving the bar have been in some places replaced by an electric motor, and it is not doubted that the so-called Jeffrey electric coal cutter is a success. Whether or not it is the most economical way to revolve the cutter-bar, or whether the system is equal to the mining of coal by other machines, is a question in dispute, but even admitting its inferiority from an economical standpoint, and though it may be heavier, the Jeffrey electric machine may justly claim advantages in that it may be applied in mines which are equipped with electric power for lighting, haulage, etc. The best evidence of the success of this Jeffrey machine is that since the experiments were begun, about two years ago, it has been installed in a number of mines, and altogether nearly fifty machines are in use.

A useful application of electricity is in revolving the spindle of a rotary drill in coal and soft ore mines. The Jeffrey rotary drill is a useful device, and one which effects a large saving over hand work. The principle is simply the revolution of an auger by means of an electric motor.

The electric mining hoist, like the electric pump, has rapidly reached the point of success, because nothing new in principle is involved. Here, too, like the case of the Jeffrey coal cutter, it has simply been the province of the mechanic to replace the reciprocating engine by an electric motor.

The electric mining locomotive, though not yet perfect, is unquestionably a success. Many types have been made, notably those of the Thomson-Van Depoele, Jeffrey and Edison. A strong point in favor of the electric locomotive is the small space it occupies in proportion to its power of traction. The so-called "terrapin-back" locomotive of the Thomson-Van Depoele Company seems to have been born in the mine, being especially suited for traction in inaccessible places, because of its compactness and strength. A 60-H. P. "terrapin-back" has a total height of only 39 in. from the rail. Much still remains to be done, especially in the line of simplifying the mechanics of an electric locomotive. There are so many gears and other moving parts that the repairs are not as low as they should be for economical service. Another feature to which electrical engineers should devote their attention is to be able to start and stop the motor without the use of a rheostat or similar device, which simply converts a portion of the electrical energy into heat. In other words, the electric locomotive should be brought to a point where, like the steam locomotive, it uses power in proportion to the work done.

The electric rotary drill with the diamond bit is a success when applied to prospecting work, and may be applied to general drilling in mines subject to the limitations of all rotary drills. It is because these limitations have been recognized that electrical engineers have devoted their attention to the percussive drill. Two electric percussive drills have been made and used during the past year, the Marvin-Edison and the Thomson-Van Depoele. The solenoid principle on which these drills are worked is not new, the conception dating back as far as 1851, in what is known as the "Page" engine. It is simply the electromagnetic attraction of a bar of iron or soft steel, the magnet being situated in a coil of wire through which electricity passes, and which takes the place of the cylinder of a steam drill—the bar of soft steel which is placed in the center of the coil is the piston. The Marvin-Edison drill is composed of the two solenoids, that is, two coils of wire, and the Thomson-Van Depoele of three. The simplicity of the electric percussive drill commends it, though experience has not yet demonstrated that the solenoid principle, without further complications, will apply to a rock drill with equal efficiency and economy as has been already acquired by steam and air drills. The heat produced by the rapid pulsations of the current is a serious objection to the electric drill. This has been in a measure relieved by the undulatory movement of the current effected by the Thomson-Van Depoele apparatus. Other difficulties are in the nature of the magnetic influence affecting the piston rod, rifle bar and other parts which necessitate their being made not only in separate pieces, but of a non-magnetic metal. It is a difficult problem to apply the solenoid principle to a rock drill and accomplish the same amount of work with a machine of light weight. An electro-magnetic apparatus is of necessity heavy in direction proportion to its capacity, while the steam drill is of greater capacity than any other engine in proportion to its weight, being about 50 lbs. per horse power.

An encouraging application of electricity for the purpose of drilling is through its conversion into pneumatic power. Electric air compressors have been made of light weight and portable, so that they may be placed within the mine at a point within a few hundred feet of the drill. Air may be compressed by means of an electric motor and delivered to the drill with the heat of compression remaining in the air. In this way the great loss which takes place in the use of compressed air, that due to shrinkage by heat, is saved; and, moreover, all the trouble by freezing in exhaust passages is obviated. The compressed air delivered hot at the drill is exhausted cold and in this way a constant circulation of air is kept up in the heading where it is most needed. If electricity may be transmitted several miles from the generating station and delivered in the mine with an efficiency of 80%, it is possible to convert it into pneumatic power, and to use this power to drive a rock drill, suffering only such losses as occur in the friction of the engines and in the radiation and leakage in the pipes; these are small items.

The stimulus given pneumatic engineers by the developments in electricity has resulted in some useful improvements in compressed air appliances. The air compressor has been improved on economical lines, even to the extent of a combination of the best Corliss engine practice with compound air cylinders. Compressed air has been produced and delivered in the engine room with an efficiency above 90%. The great loss suffered by shrinkage of volume through reduction in temperature is in great measure restored by various systems of reheating. It has been found that with a small amount of coal burned either externally or internally

the compressed air is heated and expanded so that with the same pressure an equal amount of work may be accomplished with less volume of air. Reheating compressed air has not received the attention it deserves. This is especially true in America, for the system of reheating employed in Paris, Birmingham and elsewhere has been the means by which it has been practicable to economically supply large volumes of compressed air power great distances from the generating station. Reheating by electricity promises to serve a useful purpose, owing to the absence of combustion, the simplicity of the apparatus and the fact that it is possible to convert electricity into heat unit for unit.

ARIZONA.

By John F. Blandy, M. E.

In looking over the mining field of Arizona we have to note but few changes of marked importance during the year 1891, although a great deal has been done in a small way in perhaps all the districts. The most valuable work has undoubtedly been the erection of a 20-stamp gold mill in the Harqua Hala district in the eastern edge of Yuma County upon the "big discovery" made in that section some three years ago. The mill has been running since midsummer upon rock yielding \$20 to \$25 per ton in free gold. This may now be considered the leading gold district of the Territory and will no doubt show a good record some years hence. Next to this may be reckoned the Mammoth gold mines of Pinal County. The Mammoth Gold Mines, Limited, has kept its 30-stamp mill running pretty regularly during the year and will show a product of \$250,000 to \$300,000 for the year. The company has done much to develop the mine to greater depth and has opened very large bodies of ore at the 400-ft. level. Other valuable property in the same district will most probably be opened up at an early day.

The Phoenix Gold Mining Company, in Maricopa County, has been engaged all summer in erecting a dam for water storage, which will provide water power for 100 stamps, and as it expects to be ready to run early in the coming year, it will no doubt show a good record for the year 1892, as there is an abundance of ore in sight to supply the mill. The Congress mine, which has of late years been the largest producer of gold in the Territory, was closed down in the summer, not for the want of ore, but, as it was stated, because the cost of freighting to the railroad was too great and the company preferred to await the advent of the railroad which is now being built from Phoenix to Prescott. This will pass near the mine, and will benefit a large section of country. Beside the above mentioned mines, the usual amount of gold has been obtained from the placers of Yavapai, Yuma and Mohave counties, and from sundry small mills and arrastras scattered throughout the Territory, also from ores containing both gold and silver, such as the Hillside and Crown King, of Yavapai County, the Tombstone mines, of Cochise County, and many small mines. A 10-stamp gold mill is now being erected in the Weaver district on the Yarnell mine.

There has been no marked improvement in silver mining except in Gila County, where more active work has been going on in some of the old mines, such as the Pioneer, Rescue and in Richmond Basin. The ores are very high grade, as they have to be to stand the transportation of 130-140 miles to the Southern Pacific Railroad at Wilcox Station. There has been great activity in the Tombstone district, and I learn that it is the intention to soon commence the unwatering of the large mines by a combination pumping plant. In Pima County mining continues about the same, and no doubt the annual product will be about the same as in former years. Some very promising silver and lead mines are being opened up in Graham County, but this is pre-eminently a copper county, and will remain so for many years. In Pinal County the Vehol has been the only active camp, and it has maintained its good reputation. The Reymert mine, near Florence, was closed early in the year, but the new "strike" at the old Silver King has given a renewed impetus in that section.

The leading improvements in Yavapai County have been the reopening of the old Tiger mine and the opening up and equipping of the Catoctin mine. The latter has erected a 10-stamp concentrating mill, which has been in operation about three months, but for want of water has not been able to make half time. The Tiger mill has been kept idle for the same cause. It has been a remarkably dry season throughout the Territory, and perhaps no part of it has been more affected by this cause than Yavapai County, as all the mills have been idle for the greater part of the year. This has not affected the "chloriders," and they have sold about the usual amount of ores to the sampler. At the Hillside mine a 10-stamp amalgamating and concentrating mill is being erected, and will be ready to run in January, so that a much larger product will be made there the following year than has been in this.

In Mohave County more vigorous work has been going on at Stockton Hill, the Night Hawk and at Mineral Park, and in general in most of the camps. This county is rather remarkable for the very high grade of the ores shipped. Most all the mining is in the hands of "chloriders" and leasers, but very few companies being engaged. The large production of the precious metals by such a small population certainly speaks in strong terms of its value as a mining section.

The copper industry has been increased this year by the addition of new smelters by the Buffalo Copper Company at Globe. These works have lately passed into the possession of the owners of the Copper Queen, and will no doubt be more vigorously pushed. All the old copper companies of Globe, Clifton, Bisbee and Jerome have remained in full blast during the whole year, and have no doubt made as large, and probably larger, product than in 1890. Extensive improvements have been and are being made at the United Verde mines (Jerome) by the addition of more furnaces and the erection of an elevated tramway, seven miles long, to carry their coke and products over the "Black Hills" to the railroad. When these works are in full operation the production of the mines must be largely increased, as the mines show an abundance of ore.

To the mining industry might be justly added the valuable sandstone quarries of Flagstaff, Coconino County, and the "Mexican onyx" beds of Big Bug Creek, Yavapai County, and Cove Creek, Maricopa County. The very superior quality of the Flagstaff sandstone, due to its very uniform and beautiful color, fineness of grain and strength, is becoming more and more appreciated, and it is finding a market from Chicago to San Diego

and Portland. But little of the onyx has been shipped as yet, but much has been distributed in small lots throughout the country, and the uniform favor with which it has been received gives promise of an extensive business in the near future.

The building of a north and south railroad to connect the Atlantic & Pacific Railroad with the Southern Pacific Railroad, which is now in progress, will do much for the mining industry of Arizona, especially that of Yavapai County, not only by the additional facilities for transportation of ores, but by the outlet furnished for the agricultural products of the Gila Valley, and therefore cheaper supplies to the mines. A railroad is contemplated to the copper mines of the Globe district, and will no doubt be started in near future. No more useful and profitable venture than this can be prosecuted in the whole Territory.

CALIFORNIA.

From Our Special Correspondent.

The condition of the quartz mining industry in California in 1891 has been fairly prosperous, and nearly all of the old mines along the Mother Lode that were worked in 1890 have been worked during the year just closed with equally good results. Some of them have done decidedly better, the Kennedy, at Jackson, especially, it having paid \$360,000 in dividends during the year, which is as much as the company paid in previous years put together. The famous old Idaho mine, at Grass Valley, has also done well. It is impossible to say at the present time what the amount of California's yield of gold in 1891 is, but even if it proves to be no greater than that of 1890 it is quite certain that the profit has been greater. Every year sees the introduction of improved methods of mining and milling, and quartz which could not be handled 10 years ago is now worked at a profit. Indeed, the year just passed has been quite notable for the number of old, abandoned mines that have been reopened. Nevada and Amador counties have continued to be the center of the quartz mining industry of the State, but the upper or northern portion has been attracting considerable attention. In Siskiyou and Trinity counties blue gravel in large quantities has been found and great hopes are entertained that the deposits are of as good grade and as rich as the deposits in the central counties.

The gravel mines have continued closed during the year so far as hydraulic mining is concerned, but quite a number of drift mines have been operated. The question of hydraulicking is still a sore one between the miners and the farmers. Governor Markham, in his inaugural address, suggested a revival of hydraulic mining in California, and advised that steps be taken to memorialize Congress at the earliest possible moment with the end in view that the whole subject be considered by a commission and, if possible, some means be devised by which the rich deposit of gold may be obtained without detriment to farm owners in the valleys or injury to the navigation of certain streams. Governor Markham's suggestions were warmly commended by the mining men in the legislature. The latter organized irrespective of party, and on February 13th, in the first fight, won a victory over the valley people and passed a bill "That no county bringing suit against mines or mining corporations can have the trial within its own jurisdiction." This bill was approved by the Governor. In May the Anti-Débris Association secured injunctions against a large number of mines in Yuba, Sacramento and Sutter counties. Hydraulic mining was thus brought practically to a standstill, being confined almost entirely to the Klamath River in Trinity County. In this county there was quite an increase in hydraulic operations during the year, the Act declaring the Klamath River a navigable stream having been repealed in 1890.

Majors Benyard, Heuer and Hanbury, of the U. S. Engineer Corps, who were appointed commissioners by the Secretary of War to inquire and report upon the extent to which the debris from the hydraulic mines had obstructed the navigation of the San Joaquin, Sacramento and Feather rivers, were not able, owing to the inadequate appropriation, to make an exhaustive report, but nevertheless gathered some valuable data on the subject which was published in June. The commissioners computed the amount of land along these streams ruined by hydraulic debris as follows: Along the Feather River, 17,628 acres, valued at \$1,097,038; along the Yuba River, 11,845 acres, valued at \$1,097,577, and along the Bear River, 9,741 acres, valued at \$694,970. In addition, lands adjacent to these rivers had been injured, though not destroyed, to the following extent: Along the Feather, 6,940 acres—damage \$195,750; along the Yuba, 3,500 acres—damage \$144,500; along the Bear, 3,515 acres—damage \$2,200; making a total of 39,214 acres lost, valued at \$2,871,585; and of land more or less injured, a total of 13,955 acres—damage \$422,450. These figures also cover the damage caused by the flood of 1890, which amounted to a very considerable sum. On the other hand, \$10,000,000 is being lost annually to the State, and the foothill counties have lost more than 50,000 in population by the judicial decisions prohibiting the working of the auriferous gravel beds of the State. The commissioners in their report expressed the opinion that in many instances the conditions are such that the mining debris could be so impounded that no interest, property or pursuit would suffer. The cost of the several works recommended by them was estimated as follows: Feather River wing dams, \$300,000; Sacramento wing dams, \$300,000; dam on the Yuba River at the Guerre Point, from \$300,000 to \$640,000, according to the height; dam on the Bear River, \$150,000; restriction works on the Yuba River below the foothills, \$300,000; and \$20,000 annually for maintaining navigation on the Feather River.

COLORADO.

By T. E. Schwarz, M. E.

The year 1891 has been one of great prosperity to the mining industry of Colorado. It has been marked by development of new producers in the old camps, the discovery of new camps, and the completion of railroads to some of the remote sections, stimulating more extended developments and a large ore production. The ore output of the entire State has steadily increased, until it exceeds the smelting capacity, necessitating a large increase of plant by the smelting concerns. As a result, the Omaha

& Grant, and Argo works at Denver, as well as the Arkansas Valley smelter at Leadville and others, are largely increasing their capacity.

Prices obtained by the miner for ore have not, however, been equal to those obtained in 1890, owing to two facts, namely: 1st, the excessive production above smelting capacity, rendering the buyers more independent than heretofore; 2d, the abundance of lead ores and the large amount brought into the State from the Cœur d'Alene section, under special railroad rates, to the Omaha & Grant works, over the Union Pacific. Treatment charges have increased from 25% to 50% over those of 18 months ago.

The building of the Rio Grande Southern Railroad, just completed, has been of vast importance to the southwestern portion of the State. It insures a large and increasing output from Telluride and Rico, and enables those camps to obtain cheap fuel from Durango, or to market their ore there.

Leadville has more than held its own and still is a factor in the State's annual production to the amount of fully \$12,000,000, with every probability of increasing this amount next year. The new discoveries on the Mahala and Belgium already turn out 150 tons daily. The Maid of Erin continues its enormous output at the rate of 6,000 tons per month. Many deep shafts promise new and important disclosures in the not distant future.

Aspen maintains its output well, and though not equal to Leadville in tonnage, will not fall far behind in value. The old reliable counties of Gilpin and Clear Creek maintain their regular annual output from increasing depths, and have long since established the great permanence of their fissure veins. In the latter County, the Lamartine, one of its youngest mines, still maintains its heavy production.

Probably no portion of the State has made as much progress as the San Juan section. The district about Lake City, in Hinsdale County, exhibits great improvement in output and activity in development and prospecting. About Ouray there is a marked increase in the output from the "gold belt" properties. The American & Nettie has resumed dividends, while a large and profitable production is maintained from the recent discovery on the Bright Diamond. Large additions to the plant of the Virginus mine have been made, and a long cross-cut tunnel is in progress to open it at still greater depths. At Red Mountain many new enterprises, owning carefully selected ground, are pushing for the depth necessary in this section. Among these are the Genesee-Vanderbilt, White Cloud and American Girl properties. The Guston continues to be the dividend payer par excellence, and to maintain the reputation it first made in 1888-89.

The new camp, known as Creede, situated about ten miles from Wagon Wheel Gap in Rio Grande County, is showing some wonderful ore bodies of excellent grade, in an eruptive formation. The Holy Cross at this point is shipping 30 tons daily at present, and will largely increase this amount upon completion of the railroad. Other properties there show large amounts of ore, and will also soon be shippers. It is a second Aspen, and next year will form no small factor in the State's output.

LEADVILLE.

(From our Special Correspondent.)

Any résumé of the work done in the Leadville district would be incomplete without a brief mention, at least, of the number of important strikes that have been made during the year just passed, some of which have been effected in ground wherein no pay ore had previously been thought to exist. Among these may be mentioned the Mahala, adjoining the Wolfetone mine on Carbonate Hill, where, at a depth of 778 ft. from the surface, the extension of the great Evening Star ore chute has been opened, the ore being sulphide in character and much of it of high grade.

In the Crown Point mine on Rock Hill a drift was driven to the southeast, and after cutting through a dyke of porphyry and upraising to the east of it, found a body of high grade lead carbonate.

From the Shenango shaft of the Allegheny Mining Company, a lot of prospecting was done, some of which resulted in the uncovering of a body of ore that has proved of so much value that a new shaft is being sunk to facilitate its extraction, and the Mikado Mining and Smelting Company, finding that the chute was on its line drove off to it from the main shaft and shipped considerable quantities of good pay ore during the year.

The Ward shaft of the Ad-laide has been constantly worked and in the stopes and levels from it a fine body of ore was uncovered, which enabled these people to ship at the rate of 35 tons per day of most excellent ore during the last six months of the year.

Another important strike was made in the Thompson shaft of the Aetna, where, at a depth of about 80 ft., a channel of ore in the limestone was met with, from which from 10 to 20 tons a day of extremely high grade carbonate ore has been shipped. West of the Carbonate fault a diamond drill has been brought into requisition, and in the Penrose, Grey Eagle, Lazy Bill and the Star of Hope rich ore lying in the porphyry-limestone contact has been encountered, and shafts are now going down to open these ore bodies. These strikes are very important, proving the continuation of the Carbonate Hill ore chutes almost to the center of the City of Leadville. Some 10 shafts have gone down during the year within the city limits, all of which are meeting encouraging indications, and will probably catch ore, as they are located along the strike or bend of known chutes.

On the north side of Iron Hill, in the Belgian, the extension of the Colorado No. 2 Louisville chute was encountered, and the average shipment since then has been about 35 tons a day.

The A. Y. and Minnie and the Maid of Erin mines have continued to be large producers. In the latter several important strikes have been made, and its output has been very large. The sulphide ore opened in its lower levels has been of good grade, and a large proportion of the product of the mine has been from this class of ore. In the early part of the year the stock of the Henriert & Maid Consolidated Mining Company, owning this property, was taken over by an English company, the Maid of Erin Silver Mines, Limited, which has paid three dividends, amounting to \$419,175. The new company also took over the lease of the Adams mines, and subsequently secured a lease upon the Wolfetone. It is now operating all three properties, which adjoin one another.

Attention has been drawn to Breeco Hill, a neglected part of the camp, by a good strike in the Little Johnnie, and several new shafts are now being sunk. Altogether the year has been a prosperous one for the great Carbonate Camp, and the new developments promise that the present output will be maintained for some years to come.

According to statistics compiled by the Leadville Herald-Democrat the total production of Leadville has been as follows:

Year.	Amount.	Year.	Amount.	Year.	Amount.	Year.	Amount.
1878*.....	\$10,000,000	1882.....	\$17,131,853	1886.....	\$13,750,733	1890.....	\$11,798,893
1879.....	11,333,710	1883.....	15,839,446	1887.....	12,072,968	1891.....	11,916,740
1880.....	15,095,153	1884.....	12,877,497	1888.....	11,615,265	Total..	\$181,549,818
1881.....	13,174,576	1885.....	12,357,632	1889.....	13,639,352		

*Including the production of gold, silver, and lead in 1873, and the production of gold from the California Gulch placers prior to that year.

IDAHO.

From Our Special Correspondent.

The mines of Idaho have made fully as large an output in 1891 as in 1890, but the year has had no especially noteworthy features. The Cœur d'Alene remains the most important mining section of the State and has turned out its usual quota for ore during the year, as the bins of the smelters at Denver and Omaha have testified. The Bunker Hill & Sullivan Mining and Concentrating Company has increased the capacity of its dressing works largely; their steady run was broken, however, by a strike which delayed work for a short time in the autumn. The Red Cloud and Cœur d'Alene companies have both had prosperous years and have paid substantial dividends. In November the sale of the great Morning mine, which has been talked of for a year, was consummated and the property has now passed into the hands of a Milwaukee syndicate. The purchase price is said to have been \$600,000. The year does not close auspiciously for this region, however, as it is believed that there will be a general shut down of the mines and mills early in January. This movement has been brought about by the arbitrary measures recently taken by the labor organizations, and the shut down, in case it occurs, will be in the nature of a starve out.

The largest single producer in Idaho is probably the DeLamar mine at DeLamar in Owyhee County. This property was sold by Capt. DeLamar early in the year to an English syndicate, which organized the DeLamar Mining Company, Limited. The purchase price was about \$2,000,000. Capt. DeLamar taking one-half in cash and the other in shares in the company. Since the transfer was made the small mill has been run steadily, and two dividends, amounting to \$150,000, have been declared. The new company has been increasing the capacity of the mill in the meanwhile and a much larger output will undoubtedly be made in 1892. Last month the "77-ft." vein was struck in the lower tunnel, and looked as well at that depth as higher up. The Poorman mine near Owyhee, also owned by an English company, has been operated during the year, and a very promising strike was made in the autumn. The output of the mine is already exceeding expenses by a very considerable amount, but whether it will reach the enormous figures of years past or not remains to be seen.

The Seven Devils district has not fulfilled the expectations that were formed concerning it, its inaccessibility being the chief reason apparently. The American Mining Company has done a considerable amount of prospecting work in its mines there and has spent quite a sum of money in the construction of roads, etc., but the district is completely isolated from the supply and shipping points of the surrounding country, and its development will be slow in consequence.

THE COEUR D'ALENE DISTRICT.

(From Our Special Correspondent.)

The year of 1886 was an eventful one in the history of the Cœur d'Alene mining district. In the spring of that year the Helena Concentrating Company entered into a contract to mine and concentrate 50,000 tons of ore from the Bunker Hill and Sullivan mines. This was the first dressing done in this section. Since then numerous mines have been opened, and now this district is famous the world over as a silver-lead ore producing country. Since 1886 the concentrating capacity of the mines has been increased, and to-day 460 tons of concentrates are produced every 24 hours. Each ton of concentrates represents five tons of crude ore. The following list gives the present daily output and the full capacity in concentrates of the several mines in this section, and embraces the silver-lead properties only. The figures are given in tons.

Mine.	Present output.	Full capacity.	Mines.	Present output.	Full capacity.
Bunker Hill & Sullivan	65	110	Sierra Nevada.	10	25
Poorman	40	49	Inez,		
La-t Chance	20	35	Mammoth	2	5
Badger	25	35	You Like	0	10
Gem	27	20	Gold Hunter	10	10
Union	0	35	Grouse	0	15
Custer	15	15	Stem Winder	15	15
Tiger	8	25	Several smaller mines	0	10
Black Bar	0	5			
Morning	1	40	Total.....	237	460
Granite	7	10			

These concentrates will average 39 oz. of silver per ton and 60% lead, and with silver at 94¢ and lead at \$4.30, and allowing 15% for stoppage, shutdowns, etc., we have about \$9,400,000 as the annual production for 300 working days. At least 3,000 miners are engaged in the mines in this section at average wages of \$3 per day, and some 500 laborers at \$2, which makes a pay roll of \$10,000 per day, or \$3,000,000 annually.

MICHIGAN.

By C. D. Lawton, State Commissioner of Mineral Statistics.

Copper.—Copper mining on Lake Superior has experienced a profitable year; not as much so as the previous one, but copper has held at a fair price and mining shares have sold and still sell at good figures. It has come to be generally understood that the stocks of leading Michigan copper mines are safe investments. The mines are permanently good, well managed and offer uniform, profitable results; that is, dividend paying mines do.

The work in the copper mines proceeds with much regularity; the deposits are far more uniform than are the deposits of iron ore, and thus admit of more seeming regularity in manner of working. From year to year the mines get deeper, and of greater extent laterally. New and

costly plants of machinery are provided, and, withal, the cost of the work is constantly cheapening. There has been no abatement in the vigor that has characterized the prosecution of the mining work in the copper region in the past year. The vertical shafts that the Tamarack and Calumet & Hecla companies are sinking have been extended downward with extraordinary rapidity. A greater record in sinking and drifting, per month, has been made than ever before. The mines never looked better than now, and probably the coming year will note a greater output than ever. The greater cost of mining, due to increase of depth, is more than compensated for by better hoisting facilities provided to accomplish the work. There are also other gains constantly made in stamp mill work, etc., so that the cost of copper has not even yet reached the lowest figures at which it will be probably produced. Neither has the point of maximum production been attained.

Gold.—There has been some exploring for gold veins during the past year, and rich gold bearing quartz has been found in the Huron Mountains and Dead River district, as it is called. Gold "finds" have been made which, it is believed, may be developed into valuable mines. I have seen some of the material brought in, the past summer, by reliable explorers, that was as favorable as any I have ever met with in this region. The Ropes has the only stamp mill for treating gold quartz in the State, and it continues to be operated with about the same average results as for years heretofore. At the Michigan and other neighboring gold mines the work continues to be mainly exploratory.

Iron.—The year 1891 has been an "off year" in iron ore mining in the Lake Superior region; but the outlook for this industry for the ensuing year is much better. This improved condition is due to the fact that there has been a less production—about 2,000,000 tons—of ore, as compared to 1890; and thus there is less surplus ore to be carried over, to be got rid of in the spring. It seems, also, to be almost certain that next season will be one of much business activity throughout the country. There is an almost unprecedented quantity of grain in the West and an unusual scarcity of it abroad, so that our great surplus of food must be absorbed to meet Europe in necessities, and the sale of our breadstuffs abroad will cause the return to our shores of the gold but recently sent away. In the early part of 1891 we shipped many millions to Europe and the loss was severely felt in business circles, causing a curtailment of exchanges and construction that lessened the price and the consumption of iron ore. The current of the flow of gold is already reversed and the stream which is now in our direction will increase in volume in the new year. This change cannot be otherwise than promotive of business prosperity, and thus of the greater consumption of iron ore.

Before the close of the year 1890, the contracts for the coming year's production of iron ore had been made, and at a price averaging about \$1 more per ton than for ore sold in 1890. This early sale at increased price stimulated production so greatly that the total output of ore of the mines contiguous to Lake Superior aggregated nearly 9,000,000 tons. Unfortunately a large amount of this ore remained unconsumed at the opening of navigation in 1891. The furnace men had paid a higher price for it than the ore was then worth in the market. However the contracts had been made and must be fulfilled, and thus iron was manufactured from ore, that had to be paid for at a price above the market, that left little or no margin of profit on the manufactured article. It was evident before navigation opened, last spring, that so much ore on hand must occasion a light production for the season of 1891. But now the facts that the ore is all practically taken, and there is only enough on hand for present use, and the general business outlook for the country is so good, have caused the mining agents to expect an augmentation in price next year, and surely an increase in demand. The tokens of this are even now manifest. The iron mining companies are everywhere "putting on more men." Mines and good mine laborers are in demand, and they have no trouble in finding employment at good wages.

Some valuable discoveries of iron ore have been made during the past year, and nearly everywhere the work has developed facts of a gratifying character, the evidence continues to prove that even in the oldest mines there will be no falling off in quantity of production. Some of the iron mines have penetrated to a great depth; notably the Champion, Republic, Cleveland, Lake Superior, Ludington and Hamilton. These are all old mines, some of them have been steadily worked for 36 years, and they all send up their products undiminished as of yore. An examination of any of them to-day shows that ore "holds as well" at the bottom as at the surface of the mine.

The Champion mine is now 1,100 ft. deep vertically, but it yields as large an annual product as ever, and the bottom is looking unusually well. The Ludington and the Hamilton mines, in the Menominee Range, are opened nearly 1,500 ft., vertical depth, and they never looked better than now, and the ore body is largest at the lowest level. Some other mines that are newer, and were small but a few years ago, have since developed into enormous proportions. This may be said of the Cleveland Iron Mining Company's Lake Shaft mine, where the ore deposit proves to be of extraordinary dimensions. This company, under the local superintendency of Mr. F. P. Mills, is making admirable preparations for future mining on a large scale. The mill, which is now fully completed and in operation, for framing the "timber sets," is far superior to anything of the kind on the Lake. The handling of the timbers and every portion of the framing, etc., is done by machinery with perfect accuracy and extraordinary expedition. The foundations for an engine house, that, with its machinery, will be one of the best in the region, is now being laid. All the work is thus far preparatory and will continue to be so until the water overlying the ore is removed. The ore lies wholly beneath Lake Angeline, in the City of Ishpeming, and the mining work consists of sinking the shafts, extending the drifts and cutting through the "rooms." Ultimately the company will make an output annually, equal, or nearly so, to any mine on the Lake. The deposit just east of Negaunee, in which are the Schlesinger mines, so called, has also developed very largely. There have been made some recent discoveries of ore in the Crystal Falls district that are likely to develop into mines. Unfortunately, however, the ore is non-Bessemer.

In the Gogebic Range, also, there is much that has developed that is encouraging. This is chiefly in the way of leading to the belief that ore exists, in many instances, at least, beneath the dykes that are found in all the mines in this district, and have caused much anxiety

to those interested in the mines there. Nearly all the deposits of ore that have been developed in this range have been found to lie upon a southerly foot wall of fragmental quartzite and dykes which have at some period been thrust up, emanating from lower depths and inclining upward to the north across the formation. The efforts that were at first made found little or no ore beneath these dykes, but more recent investigation is leading to better results, and it is now quite probable that the dykes do not, of necessity, terminate the ore. Ore is certainly found, in some places, under a dyke, although in other places it is not, so that one cannot, as yet, say what connection the dykes have with the ore. But a more hopeful feeling prevails regarding them than formerly.

MISSOURI.

By Arthur Winslow, State Geologist.

The principal mineral products of Missouri during the past year, in the order of their value, have been coal, zinc, lead and iron. In addition to these there are mined, dug or quarried, large quantities of building and paving stones, fire clays, limestone for the production of quick-lime, and glass-sands. Further, there are to be included among the mineral production small amounts of barite, of onyx, and also a decomposed chert known as "tripoli," which is sold as a polishing material. Small quantities of cobalt and nickel ores are mined along with the lead ores of Mine la Motte, and are shipped in a speiss to Liverpool, England, for further treatment. Copper ores also occur in Franklin and adjoining counties, and have been worked in an experimental way, on a small scale, during the past year.

Coal.—The coal production for the year ending June 30th, 1891, according to the State Mine Inspector's figures, was 2,650,028 tons, valued at \$3,480,867. This came from 37 counties distributed over the western and northern parts of the State. This production places Missouri second among the coal producing states west of the Mississippi, and ninth among the coal producing states of the Union. It is an increase of about 8% over the preceding year. Of the total amount produced nearly four-fifths came from eight counties, the amounts from each being as follows: Bates County, 726,273 tons; Lafayette County, 352,603 tons; Ray County, 282,247 tons; Randolph County, 224,758 tons; Henry County, 144,139 tons; Putnam County, 123,526 tons; Vernon County, 64,303 tons; Barton County, 63,626 tons. These figures show an advance in production in all of these counties with the exception of Randolph, where it is somewhat less than that of the past year.

There are in all 385 coal operators in the State. The Rich Hill Coal and Mining Company, of Bates County, is by far the largest producer, having mined 500,000 tons during the year. Under the same management as this are the Western Coal and Mining Company, of Bates County, and the Lexington Coal and Mining Company, of Lafayette County, both large producers. Next comes the Kansas & Texas Coal Company, with mines in Macon, Linn and Ray counties; then the Keith & Perry Coal Company, with mines in Bates and Henry counties; the Richmond Coal Company, with mines in Ray County, and Loomis & Snively in Macon County. These five companies mine about half of the total amount annually produced.

Iron.—The production of iron ore in Missouri during the year ending June 30, 1891, was 138,356 tons, valued at \$331,665. This is a decrease of nearly 40% from the production of the preceding year. In 1880, according to the census figures, Missouri ranked sixth in the Union as an iron producer; in 1889, according to the same authority, she ranked tenth, and her product had decreased about 23%. Comparing her product in 1891 with that of other states in 1889 she would now rank eleventh or twelfth. The principal mining operations are of the specular ores at the Iron Mountain mine in St. Francois County, and of the hematites at the Cherry Valley mine in Crawford County, these two mines producing the bulk of the ore. The old Pilot Knob mine, in Iron County, which has been heretofore a large producer, is now abandoned, which accounts, in large part, for the diminution of the State's product during the past year.

Further, hematites have been mined in a small way during the past year at Simmons Mountain, at the Hawkins Bank, and at the Craig bank and at the Plank mine in Dent County, and at the old Miramie mine in Phelps County. The limonites of the southern part of the State have been worked during the past year at only one point, namely, at the Lamons bank in Howell County, whence a few thousand tons of ore have been shipped to Kansas City. The furnace at Midland, in Crawford County, has been in operation during the past year, and also one furnace of the St. Louis Steel and Iron Company at Carondolet. The Sligo furnace in Dent County is to go into blast on January 1st, 1892.

The condition of iron mining in the State calls for serious consideration. The examinations of the Geological Survey during the past year give color to the hope that it will revive before long, and especially with the limonites of the southern part of the State, is there promise of future development.

Lead.—Lead is also a distinctive product of the State, though to a smaller degree than is zinc. According to the figures of the State Mine Inspector, the total product for the year ending June 30, 1891, was 19,967 tons of pig lead and 17,030 tons of lead ore, with an aggregate value of \$2,411,399, showing an increase in product of 10% over that of the preceding year. Missouri ranks second among the states of the Union as a lead producer. Lead ore is mined along with the zinc ores of the southwestern and central parts of the State in Jasper, Lawrence, Newton and other counties, but by far the larger portion comes from the disseminated ores of the southeastern counties of St. Francois, Madison, Washington and Jefferson, as much as three-fourths being from this district. Here the St. Joseph Lead Company, at Bonne Terre, and the Doe Run Lead Company, both in St. Francois County, are the largest producers, their combined output being from 1,500 to 2,000 pigs of lead per day. The Mine La Motte, in Madison County, and the Valle mines, in Washington County, are also large producers. The lead ores in St. Francois and Madison counties are smelted in furnaces located at the respective mines;

* In the preparation of this article I am especially indebted for notes and figures to Mr. Frank L. Naason, Assistant Geologist in charge of Iron and Manganese; to Mr. J. H. Robertson, Assistant in the Zinc and Lead Regions; to Mr. C. C. Woodson, State Mine Inspector; and to Mr. Jessie A. Zook, mining correspondent of Joplin, Mo.—A. W.

those of Southwestern Missouri are treated at the Picher white lead works in Joplin, at the Argentine smelter in Kansas and at the St. Louis Refining and Smelting Company's works at Cheltenham. In Morgan, Miller, Cole, Washington and Jefferson counties are small furnaces handling the local products.

Zinc.—Zinc is pronouncedly Missouri's distinctive mineral product, and in the amount and value of the output she is far in advance of every other state in the Union. The total production, according to the figures of the State Mine Inspector, for the year ending June 30th, was 123,707 tons, valued at \$2,673,073. This is an increase of nearly 25% over the recorded production of the preceding year. Zinc mining is concentrated in the southwestern part of the State and there especially in Jasper County, in and about the towns of Joplin, Webb City, Carthage, Mo., and Galena, Kan. Here the Empire mines, the mines on Turkey Creek, the Tracy, the Eleventh Hour and the Center Creek mines are among the most important, they together producing perhaps about half of the total amount of the County. In Newton County, just south of Jasper, zinc is also mined, principally at the Granby mines. In the adjoining County of Lawrence, to the east of Aurora, are mines on the Orchard tract, the Bonanza mines, the Black lands and the Vance lands, from all of which zinc is mined, partly as silicate and partly as blende. Small amounts of zinc are also mined in Greene and Christian counties, and prospecting to a greater or less extent is being prosecuted in Barry, Dade, Wright Texas, Shannon, Carter, Ripley, Douglas, Stone, McDonald, Laclede, Phelps, Pulaski, Dent and Crawford counties. Some of the zinc ore is smelted at the mines of the Empire Company and some at Rich Hill and Nevada in the State; but the larger part is shipped elsewhere for treatment, especially to Pittsburg, Kan., to St. Louis, and to Peru, Collinsville and La Salle, Ill. Shipments have also been made to England, to Vivian & Sons, and during the past year a few thousand tons have been sent to Germany. It is doubtful, however, whether the latter point will ever become a permanent market, as the freight charges there, at the prices offered, reduce the profits to nil or less.

The following interesting figures concerning the sale of zinc and lead ores in the Jasper County district are kindly advanced by Mr. Jesse A. Zook, mining correspondent, of Joplin, Mo.:

SALES OF ZINC AND LEAD ORES IN THE JOPLIN DISTRICT FOR THE YEARS 1890 AND 1891.*

Sales for 1890, by months.			Sales for 1891, by months.				
	Zinc ores, lbs.	Lead ores, lbs.	Value.		Zinc ores, lbs.	Lead ore, lbs.	Value.
Jan...	10,010,580	1,068,000	\$150,669	Jan...	18,579,270	2,332,130	\$273,725
Feb...	17,761,930	1,487,620	17,229	Feb...	19,524,260	1,503,400	253,368
March...	16,686,280	1,541,180	209,032	March...	19,853,430	1,624,330	273,898
April...	17,037,890	1,378,650	218,042	April...	18,696,040	1,564,640	259,371
May...	23,475,310	2,456,660	327,370	May...	27,626,350	2,292,510	362,367
June...	18,487,580	2,325,770	269,770	June...	26,660,220	1,629,380	309,702
July...	14,828,040	1,640,790	228,179	July...	19,145,290	1,783,160	261,406
Aug...	20,384,520	1,541,160	277,573	Aug...	25,016,120	2,435,070	343,110
Sept...	14,620,570	1,353,680	215,167	Sept...	20,898,210	2,062,550	296,522
Oct...	18,371,490	1,990,920	283,777	Oct...	27,544,890	3,218,460	383,779
Nov...	22,262,700	2,651,760	360,776	Nov...	21,927,330	3,245,900	300,911
Dec...	13,377,170	1,607,700	212,045	Dec...	22,000,000	3,000,000	319,000
Total	217,303,540	21,325,890	2,927,552	Total	277,741,380	27,051,600	3,621,539

* These tables include Galena, Kan., but the production from that place will about offset that from Carthage and Aurora, Mo., which is not included. ** Estimated.

MONMONTANA.

From Our Special Correspondent.

The year just passed has been a prosperous one in Montana, and notwithstanding the idleness of the largest producer, the Anaconda, and the falling off in the product of such important mines as the Granite Mountain and the Drum Lummon, it is probable that the mineral output has exceeded that of 1890. This is due in part to the greater outturn of many of the other mines at Butte, but in great measure to the activity at the numerous small camps throughout the State. Montana has shared in the general boom which has pervaded the mining interests throughout the Rocky Mountains during 1891, and as a result many new mines have been discovered and many old ones reopened, the output of which helps to swell the total.

The Granite Mountain Mining Company, of Deer Lodge County, has paid \$1,400,000 in dividends, against \$2,400,000 in 1890, but the falling off is in part made up by the increase in the amount paid by its neighbor, the Bimetallic, which has declared dividends amounting to \$840,000, against \$290,000 in 1890. These two mines may be called the Ontario and Daly of Montana. The Elkborn mine, in Jefferson County, has had an excellent year, and has made a largely increased output, while a recent strike in the 1,200-ft. level is of such magnitude, from present appearances, that 1892 will in all likelihood be another prosperous year for this company. Many of the old gold mines around Bannock have done very well during the past year, notably the Golden Leaf and Empire, which are now being worked at a good profit. More attention has been paid to the placers in this and other parts of the State than in the preceding year, and it is likely that the product of gold from this source will show a small increase.

The Castle Mountain district, in Meagher County, has been rather dull, although considerable development work has been done with results that augur well for the future of these mines. The Cumberland, which is the most extensively explored mine in the district has continued to be the largest producer. The furnace of this company at Castle has been run during the year and has turned out a considerable quantity of bullion, and has done very well considering the difficulties as regards transportation under which the company labors. The Yellowstone Mining and Smelting Company has been reorganized and has resumed the exploration of its mine with renewed energy. The developments made in the district seem to show that the ore bodies may be expected to continue in full strength, to considerable depths and in the Cumberland mine, at least, the grade of the ore has improved. It is hardly likely, however, that Castle will make a large output until a railway is built thither.

BUTTE.

(From our Special Correspondent.)

Many fresh features have been exhibited in Butte during the year just closed. For several months, from spring to fall, the most important mining company of the district, the Anaconda, had all its mines shut down, a few men only being kept at work in order to maintain them in proper condition. Such a closing down a few years ago would have been most disastrous to this city, but this year its effect was hardly felt. The other large companies here have each been increasing their operations, and many new and valuable properties have been opened up which give promise of being in successful operation for many years to come.

The Butte & Boston Mining Company has been the most active and progressive in its operations. It has extended its plant so as to increase its smelting capacity from less than 1,000,000 lbs. of fine copper per month to 2,000,000 lbs. per month. It has equipped some of its larger mines with excellent machinery and has acquired considerable property, or is in process of acquiring it, which will give it a very large supply of ore for years to come. The Boston & Montana Consolidated Copper and Silver Mining Company has not made any important changes in its works at Butte. At Great Falls, however, it will soon have completed one of the finest plants in the country for the treatment of copper ores. The Parrot Silver and Copper Company, while not having increased its plant to any great extent, has acquired considerable additional property in this camp, notably the Little Mina and the Moscow mines. The Parrot is the only smelter in the camp that converts its matte into ingot copper. Its product all goes to Ansonia, Conn., to be refined.

The Colorado Smelting and Mining Company has been enlarging its smelting plant very considerably. It is also erecting and has nearly completed new dressing works, designed to treat 200 tons of ore daily. The company intends to continue to run its old dressing works, which have a capacity of 120 tons per day in addition to the new one when completed. The output of this company all goes to the Argo Works, near Denver, of the Boston & Colorado Smelting Company, of which it was originally an off-shoot. The Butte Reduction Works have enlarged and improved their plant. A number of kilns or stalls, in which to roast ore, have been erected, all the coarse ore having been formerly roasted in open piles or heaps. The change was made principally to conform with an ordinance passed by the council of Butte City, which prohibits the roasting in heaps and provides that all fumes from burning ore shall pass up through a stack having a height of not less than 75 ft. The stack, 112½ ft. high, which the Butte Reduction Works erected, is of sufficient size to take the fumes from about 2,500 tons of ore burning at one time.

The only other smelting works in this vicinity are the Anaconda, which are situated in the town of the same name, about 26 miles from Butte. For between seven and eight months this smelter was shut down, but about one-half of the works have been started up again and several of the company's mines in Butte have also resumed operations, so that at the present time there are more mines in Butte in active operation than ever before in its history.

Among the new companies that have commenced operations this year the Butte Copper Company promises to be the most important. This company began by taking a lease and bond on the Ground Squirrel claim, in a part of the city where no mining was being carried on. The ground had in fact been platted, and formed an addition to the City of Butte, and it was considered principally valuable for residence purposes. Since the Butte Copper Company has been working there, however, the property has been proved to be exceedingly rich in copper. The company, finding itself so successful in this mine, has taken bonds on several other properties, including the Rarus and the Snohomish. If the company is equally fortunate in discovering ore in the properties that it has bonded as it has been in the Ground Squirrel it will soon come to the front as one of the largest copper producers in this district.

As an individual operator the Hon. W. A. Clark, who with his brother, Mr. J. Ross Clark, owns the Butte Reduction Works, has not been idle. In addition to the mines he formerly held he has acquired the Skip, the Woolman and the Home. He has also leased and bonded the Nora and the Lucky Jim, which are located near the Ground Squirrel.

While the copper industry here has been so successful during the past year silver mining has been no less so. The Alice Gold and Silver Mining Company, of Walkerville, has kept in the front rank of the bullion producers of the camp. It has completed payments on the several mines that it bonded in 1890, and now owns a property aggregating over 140 acres. The company has been adding largely to its plant and developing its mines so as to insure a supply of ore to run its mills for several years to come. Except the Butte & Boston Mining Company it is doubtful if any company here has expended as much money in improvements and developments as the Alice has done this year. The Moulton Mining Company has sunk its shaft from the 700-ft. level to the 850-ft. and has been for some time prospecting on the latter. It has kept its mill running constantly, but chiefly on ore brought from other mines.

The Société Anonyme de Lexington has also been obliged to depend principally upon outside mines to keep its mill running, its own property not having produced anything like enough ore. This company has expended large sums of money in developing its mines and searching for ore, and it is to be regretted that it has met with such poor success.

The Blue Bird Mining Company is running to its full capacity. Its leaching plant at the present time is, however, shut down. The reason for shutting down is understood to arise from the difficulty of sampling the product. The product of the leaching plant ran from 50% to 60% in silver, and the company found so great a difference in the assays obtained in selling the product that it concluded to shut it down until it should build a furnace, so that it might treat the product and convert it into silver bullion itself. The Silver Bow mill, owned by the Butte & Boston Mining Company, has been in active operation during the year, but at the present time is shut down for repairs.

Among the more recent silver mining companies that have been operating here during the year the Bannister Mining Company, started in 1890, has made the best record, having paid a handsome dividend every month. This company is operating the Vulcan mine. This mine was shut down for several years and few people had the courage to touch it on account of its being very wet and requiring powerful pumps to keep it free from water. The result however, has amply rewarded the Bannister Company for working it.

The Ophir Mining Company has just completed the purchase of the Ophir mine. This property promises to become one of the most valuable of our silver producers. Although only down 200 ft. a body of ore of very great value has been exposed. The ore is not only rich in silver but also in gold, the first class running from 250 to 300 oz. in silver and from \$40 to \$50 in gold per ton. The company has uncovered a body of ore that assays over 500 oz. silver per ton.

The Consolidated Morning Star Mining Company, owned almost entirely by W. A. and J. R. Clark, has recently begun operations, having acquired the Morning Star and William Penn mines, which are located near the heart of the city. The shaft is being sunk from the 200-ft. to the 300-ft. level. This is a very wet mine but it promises to be a rich one, assays of ore taken from the shaft in sinking varying from 50 oz. to over 300 oz. silver per ton.

In addition to the companies which have been mentioned by name, there are a great many small mines operated by individuals that are more or less productive and give employment to a large number of men.

As the mines in this camp become more developed the law of apex gives the lawyers more work to do each year. The principal litigation this year has been the Bell-Speculator case, the Anaconda Company trying to prove that the apex of the Speculator vein was in Bell ground. This case was before a jury for five or six weeks and finally terminated in the jury disagreeing. The Blue Bird Mining Company arranged the case brought by James A. Murray against it for extracting ore belonging to him, and resumed operations. It is not out of the woods yet, however, as Mr. P. A. Largey, who was a partner of James A. Murray, still has a suit pending against the company for nearly two million dollars. The Butte & Boston Mining Company and the Butte Copper Company have a dispute over the Ground Squirrel, the Butte Copper Company claiming that that portion of the Ground Squirrel that the Butte & Boston Company owns was sold to them in such a manner that they cannot follow the course of the vein outside their surface side lines. The result of this suit will probably be to upset a good many placer patents on which quartz mines were known to exist before the patents to the placers were granted.

Regarding the future of Butte as a mining camp, everything points to continued and increased prosperity for a great many years to come. As regards Butte as a city, its prosperity must depend considerably upon its ability to get along amicably with the great companies operating here. At the present writing the city is suffering from the smoke from the smelters, and the real estate men, who think that if there were no smoke in Butte real estate would advance 50% in value, are at the head of a movement to fight the Boston & Montana Company and to interfere with its smelting operations. It is to be deplored that these citizens carry sufficient weight to engender a feeling of hostility against the smelters among a section of the citizens of Butte.

NEVADA.

From Our Special Correspondent.

A review of the mining industry in Nevada in 1891 is necessarily brief, there having been few developments of much importance. Early in the year it was given out that the magnates of the Comstock had decided to unwater and reopen the lower levels of the middle and north end mines, and there was joy among the miners of Virginia City in consequence, but the day when the middle and north end of the Comstock will be producing from below the present water level seems still far distant. Steady progress has been made in pumping out the Gold Hill mines, however, and exploration work has been commenced in the lower levels as fast as unwatered. Some interesting developments have been made in the West ledge during the year, and this is now regarded in Virginia City as a separate and distinct ledge formation of much promise; but, of course, time and work can only tell what it will amount to. The principal interest in the Comstock mines at present centers in the exposures of mill ring methods and the suit of M. W. Fox vs. the Hale & Norcross Silver Mining Company which is now on trial at San Francisco. The Consolidated California & Virginia is the only Comstock company that has paid a dividend during the year.

In the Eureka district there has been a considerable number of small mines worked and some of them have done quite well. The Eureka and Richmond companies have both paid small dividends, but the output of the latter company has not been large and its distribution to the shareholders came principally from its reserve fund. The old Ruby and Dunderberg mines have been worked quite steadily with a small force of men with very indifferent success. The Eureka furnaces were run for a good part of the year, but early in the Autumn they were blown out and the ore has since been shipped to outside points for reduction. The year has been, on the whole, a fairly prosperous one in the Eureka district.

The Tuscarora and Candelaria mines have made about the same record in 1891 as in the preceding year; in the autumn, however, quite important strikes were made in several mines of the former group, and since that time there has been a decided increase in output. There was a good deal of excitement in Nevada in August over a reported strike of fabulously rich gold ore at Pine Nut, in Douglas County, and there was quite a rush of prospectors thither from other districts. Some exceedingly rich specimens were exhibited, and several companies with large capitals were organized in San Francisco to operate at the new camp, but nothing important came from the excitement. Some attention was paid to the old mining camps in the eastern part of the State, along the Utah line, during the Deep Creek excitement in Utah, but this also was without important results.

At Pioche the Pioche Mining and Reduction Company, which is reopening the old Raymond & Ely, Yuba and other mines on an extensive scale, has done a large amount of development work during the year. Railways have been built connecting the most important mines with the smelting works, and the old smelting works have been removed to a more favorable location and rebuilt, with new furnaces, etc. The new works were put in blast in the autumn and since that time have been producing bullion. Several important strikes were made in the Day, Mendha and other mines of the group during the year, and the outlook for this company seems to be quite favorable.

NEW MEXICO.

By Walter C. Hadley.

To one who has watched the statistics of New Mexico's ore product for the past half dozen years it must have appeared that her star had passed the zenith and was low down in the horizon. This idea is not correct. The fact is, there has been a slight improvement generally, although at present there are fewer mines in bonanza than is usual; but the statistics have been more honestly collected from more candid producers. The requirements of the Department of Mines and Mining of the Eleventh Census—sworn statements—helped to bring this about. We have seen, some years ago, the Territory credited with \$5,000,000 product in gold and silver, when it is probable that \$1,500,000 would have covered it. It might have paid six years ago to boom with falsehoods, but the coming down to facts is what hurts posterity. The writer is of opinion that the year 1891 has been up to the average of the past eight years, though possibly 10% below it; with a notable increase in the lead product and decrease in the silver output. Copper is not one of the principal products of New Mexico. The number of fairly profitable small mines with slight ore reserves is large, and mining has become, in parts of New Mexico, especially in Grant and Sierra counties, an industry of the people and not alone of the thoroughbred miner.

Nearly all of the output of metals from New Mexico comes from west of the Rio Grande and south of the latitude of Santa Fe. The only exceptions are the mines of the southern part of Santa Fe County and the White Oaks and Organ Mountain districts. The English company operating the Cash Entry mine, near Cerillos, has expended large sums of money in development and machinery during the year. The San Pedro copper mine—easily the chief copper producer of the Territory—has added little luster to her record this year. The Lincoln-Lucky mines are now being worked with good results. The most prominent success achieved, however, has been that of the owners of the Old Abe gold mine at White Oaks, which has been systematically developed during the year and which has produced probably one-third of the entire gold output of the Territory for 1891.

The southwest portion of the Territory—west of the Rio Grande—is more productive of the precious metals. Socorro County produced largely of lead carbonates low in silver from the well known mines of the Magdalena mountains. A 20-stamp mill was erected on the Last Chance mine in the Mogollons Mountains and is now turning out bullion of which the value is about one-third gold. The Maud S., Vingo and Confidence mines have also been actively worked, and from the first two ores running high in gold have been milled in the district or at Silver City.

In Sierra County the Hermosa, Percha and Chloride districts have remained *in statu quo*. Hillsboro has been unfortunate by reason of bad management, although the Bonanza mine has been worked at a profit. Kingston's record is somewhat improved and her future prospects are much brighter by reason of the apparently successful operations of a new reduction works. Lake Valley has produced from 15 to 20 cars of ore per month during the year.

In Grant County there has been the usual amount of work done in the line belt that has for years produced, at times, phenomenally rich bodies of chloride ores. Pinos Altos, the chief gold producing camp of the county, has taken a long stride backwards, a result of bad management. The Mountain Key, a heavy producer since it was opened, is a total wreck, and it should not have been. Other mines there are doing moderately well. The Alhambra (native silver), at Bullard's Peak, the Jim Crow and Imperial mines (gold and silver), at Carlisle, and the Uncle Sam (silver), at Lone Mountain, are among the most prominent producers in the other camps. The Cook's Peak district has produced about 350 cars of lead carbonate ore carrying small values in silver, and about 125 cars of galena ore running somewhat higher in silver.

The Flagler Reduction Works (leaching and smelting), at Silver City, have been in constant operation for several months. Socorro is yet the only custom smelting point in the Territory although El Paso is on the border. Both concerns, it is said, have been forced to refuse ores offered to them during the year. Additional smelters in this part of the world are a necessity at the present time, as the amount of ore that comes in from the Sierra Madre country in Chihuahua and Sonora is greatly on the increase, and additional railway facilities are now assured.

At this time it is impossible to give the actual figures for the year's output, but in round numbers, estimated upon New York values, they are probably about as follows: Gold, \$500,000; silver, \$1,500,000; lead, \$500,000; copper, \$60,000; total, \$2,560,000.

OREGON.

By Wm. Huntley Hampton.

Mining in Oregon during the past year has shown a greater activity than for several years. There has been a number of new and important discoveries in the various parts of the State, and one of these, in Baker County, is already on the list of producers. In Eastern Oregon, comprising the counties of Union, Baker, Wallowa, Grant, Malheur, and Umatilla, the general outlook is good for an active future. The placer mines produced more than they have for years, having had an ample amount of water during the season. There has been active development in most of the districts, especially the silver districts on Greenhorn Mountain, in Grant County, and on Rock Creek, in Baker County. There are at present six steady gold producers in Baker and Union counties, but there are no silver producers in the State at present. The old Monumental Mill in Grant County is expected to start soon, however, as a custom mill, to treat the ores of the Greenhorn district.

The mineral resources of the north-central and western parts of the State consist chiefly of coal and iron, which are now attracting considerable attention, and are bound to attract more in the future. Considerable development work has been done in coal during the year, and there has been a regular production of pig iron. The coals are lignites, in various stages of metamorphosis, like the other Pacific Coast coals, and the iron ores are for the most part limonites. There are also undeveloped deposits of hematite in the State. In this portion of Oregon there are several

paratively new gold districts along the Cascade Range in which considerable development work has been done. Some bullion has been produced, and very promising results obtained. The future will see greater activity in these districts.

In the southwestern part of the State mining work is mostly confined to the gold placers, which have produced better this year than for several years past. This branch of mining is, however, still in its infancy in this section, as well as in the other parts of the State. There are several large companies which have been preparing themselves by opening up their property for future steady work, and will no doubt soon be added to the list of producers. Southwestern Oregon has no producing quartz mines, little progress having been made in this branch of the mining industry since the mines, which were so eagerly sought in early days, were proved to be of a precarious, pockety character. Nevertheless there are in Josephine and Jackson counties some very promising auriferous quartz ledges. The average gold miner in this section of the country is the old placer miner and pocket hunter of early days, and consequently the districts most frequented by others have been those where the pocket hunter has struck it, and spent all he took out in hunting another pocket. There is another class of miners in this section, the ranchmen, who, when the winter rains come on, ground sluice, etc., for several weeks, and then turn their attention to their ranches for the balance of the year. Southwestern Oregon is to be credited again this year as a producer of quicksilver, the old Todd mine near Oakland, Douglas County, having been reopened after lying idle for a number of years. It promises to be a steady producer in the future. Large and important deposits of this metal exist in this part of the State.

SOUTH DAKOTA.

By Prof. F. R. Carpenter.

Metal mining in South Dakota is confined exclusively to the southwestern part of the State in the area known as the Black Hills, which consists of a small Archæan uplift, from all sides of which the later sedimentary rocks dip outwardly. The free gold deposits, like the Homestake, are found in the Archæan rocks; the so-called "flat deposits," like the Golden Reward in the Potsdam; and the carbonate ores, like the Iron Hill, are found in those of Carboniferous age. The principal industry is confined to the northern end of the uplift and almost entirely to one county, and the value of the output is overwhelmingly in the gold produced.

Gold.—The most important mines are those of the Homestake and its allied companies, viz., Golden Star, Highland, Deadwood-Terra, Father de Smet and Caledonia, owning six mills and together dropping 700 stamps, and crushing daily, when the shoes and dies are new, 2,800 tons of rock, which produces annually about \$2,250,000. These companies mine low grade, free milling gold ores which occur as chutes or lenses of pyriticiferous schist in a belt of Archæan rocks about 6,000 ft. long and 1,600 ft. wide. It is difficult to give the average value of the rock mined, as no systematic assaying is done, but the yield under the stamps varies from \$2 per ton at the Deadwood-Terra to \$3.50 per ton at the Homestake, while the tailings assay from 25c. when running upon oxidized ores to as high as \$2.50 when treating undecomposed ores. The tailings yield from 3% to 4% pyrite, which has been successfully concentrated, though in a small way, during the past year, upon the Gilpin County bump tables.

Recently the Caledonia, heretofore an independent company, passed to the management of the Homestake, which also acquired the Pierce-Badger mines joining them upon the south, as well as the Lardner water right. The Pierce-Badger was a most valuable acquisition, as the ground is believed to be quite as valuable as any heretofore owned by the company. As the whole "belt" has virtually passed under one management, there appears no valid reason why increased dividends may not be expected in the near future, and certainly the exhaustion of these mines will not be a matter for consideration for years to come.

West of the Homestake are the deposits known as the Ruby Basin and Bald Mountain mines. The ores consist of impregnations of certain parts of the Potsdam sandstone, and usually occur in horizontal chutes, 10 to 20 ft. wide, 5 to 8 ft. high and of unknown length, but usually parallel to the numerous porphyry dykes that cut the section. These ores average 75% silica and carry usually an ounce of gold, with from two to ten ounces of silver. Their development has given rise to scenes of the wildest activity during the past year, resulting in the whole section being crossed and recrossed by four competing railroad lines, until almost every mine has a "spur" reaching its dumps. Nor have the "process" men been less active than the railroads. Almost every known (and unknown) process from the days of Agricola down has had an advocate. We have had chlorine, bromine and cyanide processes, the Leedy, the McGhee and the "chick quick"—pyritic smelting, matte smelting, lixiviation and amalgamation; but out of all this array two at least seem destined to hold the fort, viz., chlorination and matte smelting, though the first, of course, loses the silver.

The Golden Reward Mining Company has successfully operated a chlorination plant at Deadwood, treating about 60 to 70 tons of ore per day. It is increasing the size of its plant to nearly or quite double its present capacity. Near these works the Portland Company is erecting a like plant of 100 tons daily capacity, while the Welcome Company is building, also, a 100-ton plant at Rapid City for the treatment of these ores.

The same silicious ores, with others, are smelted by the Deadwood & Delaware Smelting Company, which operates what is probably the largest single plant in the Hills. It makes an iron matte which collects the gold and silver, and the works were a metallurgical success from the start, but great difficulty was encountered in disposing of the matte, the lead smelters declining, with one exception, to buy it at any price. The company is at present engaged in adding a refinery to its plant and will resume operations January 1st, 1892. Its entire yard capacity is at present filled to its utmost limit with ore.

The management of the well known Iron Hill Mining Company, at Carbonate, changed hands recently and signs of renewed activity are to be seen in that camp upon every hand.

Lead.—Two new lead districts were discovered during the past year, one in the Archæan rocks near Galena, where lead had heretofore been

found only in small chutes in the flat Potsdam formation, and the other in Custer County, also in the Archæan area. These deposits are a new development in the Black Hills and have an important bearing upon the future smelting industry of the section.

Tin.—In the Nigger Hill section, no work save assessment work has been done during the past year. In the Harney Peak region the most important change has been the placing of the work of development in the hands of practical miners, rather than the "agricultural miners" who have heretofore had charge. The work of development continues. Railroads connecting the various mines are being constructed, and a large mill of 250 tons daily capacity is being erected. The mines are being opened in a workmanlike manner, and the friends of the enterprise are still "hopeful"—but whether tin in paying quantities will ever be produced is as yet problematical.

The past year has been one of actual development, and by far the most important in the history of mining in the Black Hills. It has been disgraced by no wildcat deals, such as have sometimes characterized other years. The outlook for the coming year is equally bright and an increased production is confidently expected.

SOUTHERN STATES.

By Stuart W. Cramer, M. E.

The production of gold and silver in the Southern States during the past year would seem to indicate but little change in the condition of this industry. In reviewing the work of the producing mines, however, the most noteworthy fact is that less speculation and more legitimate mining is being carried on than for some years. Heretofore the dominant idea has been to sell, now it is being replaced by a disposition to work.

The ores of this section are generally of low grade, in fact experience teaches that none other can be depended upon, the average value not exceeding \$4 or \$5 per ton, and a part of that existing in sulphurets. Consequently, in order to mine and treat them profitably it requires close attention to details that have hitherto for the most part been overlooked. It is a startling assertion to make, but I do not hesitate to say that in my opinion up to the last year or two, for some years there has been more money expended than was realized on the bullion produced. Money has been squandered in the erection of elaborate and costly milling and reduction plants, while the underground work was carried on in such a niggardly manner that they were soon closed down for want of ore. During the past year, however, I am satisfied that the average work of all the mines was at a slight profit, which bids fair to be considerably increased in 1892.

The production of gold and silver in the States of Maryland, Virginia, North Carolina, South Carolina, Georgia, Alabama and Tennessee, approximates \$300,000, a loss of about \$50,000, as compared with that of the preceding year. The bulk of it is credited respectively to South Carolina, North Carolina and Georgia; that of South Carolina is almost entirely the output of two mines, the Haile and the Brewer, in Lancaster and Chesterfield counties, respectively. The work at the Haile is probably familiar to many readers of the ENGINEERING AND MINING JOURNAL, as it has been more or less described in the *Transactions* of the American Institute of Mining Engineers; so I will simply say that the success achieved there illustrates what can be done at other places in the district with equally efficient and prudent management.

The output of North Carolina is scattered, a considerable percentage of it being the result of petty mining. Among the producing mines may be mentioned the Catawba, the Howie, and the New Hoover Hill. The Appalachian, it is understood, has closed down permanently. The New Russell has been undergoing tests as to the adaptability of the process of the Gold Ores Reduction Company, of London, to its ores. There has been a little less, if anything, than the usual number of bubbles blown for the credulous public, though I believe there are one or two very choice specimens now trying to float. This remark is even more applicable to Georgia, whose production has considerably dwindled during the past two years. The Hand Company, of Dahlonega, which has been in successful operation for many years, is still holding its own. The Franklin, of Cherokee County, a large producer in 1890, suspended operations early in the year, which have not been resumed as yet to the best of my knowledge. It is regarded as one of the best mines in the State. The Columbia and Walker properties, which have been worked on tribute for the past two years, considerably increased their output, especially during the latter part of the year.

In Maryland the suspension of operations by the Sawyer & Kirk Mining and Milling Company decreased the production of the year. On the whole we may summarize the present condition of this industry in the South by stating that the production is somewhat short, but that more of it is profit; that less money has been invested, but the results are more satisfactory.

As necessarily brief as such a review as this must be, it would not be complete without at least a passing mention of the recent attention which the sulphur in the auriferous pyrites is receiving. Nearly three years ago Manager Thies, at the Haile, urged upon his company the importance of utilizing the gasses from roasting concentrates for making sulphuric acid, but for reasons satisfactory to themselves no action in that direction has yet been taken. A prominent capitalist of Charlotte, N. C., is now investigating the practicability of such a plant to be operated in connection with the acid plant of a cotton seed oil and fertilizer works, and that he will succeed I have not the slightest doubt.

TEXAS.

By W. H. von Streeruwitz, Assistant State Geologist.

Of the parts of Texas where mining for metals might be carried on successfully, the portion between the Rio Grande and the Pecos rivers may be named first, being the larger district, covering about 35,000 square miles. Next to it I name the central district, including Llano, Burnett, Mason, part of Lampasas, Gillespie, and smaller portions of other adjacent counties.

The quantity and quality of the iron deposits of Llano County have been sufficiently ventilated in the newspapers during the last four or five years, so that it seems superfluous to say anything more on that subject; less known, however, is the fact that there are very numerous and promising outcrops of silver and gold bearing copper and lead ores in Central Texas, together with indications of tin. It is also hardly known that this part of Texas abounds in rare minerals, and that only a few weeks ago a fine gold prospect was opened on Beaver Creek.

In Trans Pecos, Tex., I have ascertained, beyond any doubt, the presence of iron, lead, zinc, copper, silver, gold, uranium and molybdenum, and I have no doubt that tin, nickel and cobalt exist in greater quantities than the traces found up to the present time. It is, therefore, not the want of indications and outcrops that prevents prospectors from working up West Texas; nor is it the fault of the State mining law, which, though weak and defective, gives plenty of inducements. But the fact that a large portion of Texas is really mining land, equal to the best, is not generally known. Indeed, many people in the North and East know and believe more about the mines and mineral wealth of Africa than they do about Texas.

The few local prospectors who have made attempts to open mines have been mostly inexperienced, prospecting without knowing how the ore for which they were digging looked, and expecting too much from what they proudly called mines. Nevertheless there are some properties being worked at present, first among which is the Shafter mine in the Chantee Mts. It works, with 10 stamps, a free milling ore, shipping monthly 30,000 to 40,000 ozs. of silver, besides mining a good deal of galena. There are some more prospects in these mountains, and, although I am not reliably informed concerning them, judging from the character of the mountains and their rocks I have not the least doubt that the mines will "turn out all right" if faithfully worked.

The Hazel mine, in the Sierra Diablo, works on a vein nearly 35 ft. wide, opened to about 600 ft. There have been several thousand tons of well paying silver bearing copper ores (mostly sulphides) shipped from this mine, and specimens running up to 2,000 ozs. silver per ton and more are not uncommon. The Bonanza and Alice Ray in the Guitman Mountains work a fine ledge of argentiferous lead and zinc sulphides, and numerous prospects, outcrops, and unmistakable indications exist in this neighborhood, but not even the assessment work required by law has been done on most of these claims during the past year.

UTAH.

By A. Hanauer.

Utah's output for 1891, both as to tonnage and value, will be found to be the largest in her history. All the old producing camps, Park City, Bingham and Tintic, have excelled their former record. The Cottonwoods have done better than during any recent year, as has Beaver County, where the Horn Silver's output has been very large. Silver Reef (Washington County) alone seems to be retrograding. The old districts of Tooele County have held their own, and within their borders are to be found the most promising of our recently developed districts, Fish Springs and Dugway, the direct results of the "Deep Creek" agitation of 1891. Considerable development work has been done in the vicinity of Marysvale, causing Piute to be numbered in the ranks of our producing counties. Another new district is La Plata, in Cache County, but its discovery is so recent, that its effect upon the Territory's output is rather a questionable one. On the whole, the mining industry of Utah is in a healthy, prosperous and progressive condition, and with promised railroad facilities in the direction of the Deep Creek and other new producing districts, we can look toward 1892 with much confidence.

THE PARK CITY, TINTIC AND BINGHAM DISTRICTS.

(From our Special Correspondent.)

The bulk of Utah's production of gold, silver and lead in 1891, as in previous years, has come from the Park City, Tintic and Bingham districts, in all of which the past year has been an unusually prosperous one. The Daly and Ontario mines at Park City have been worked with about the usual results. For the first eleven months of the year the shipments from the former were: ore valued at \$285,838 and sulphides valued at \$278,637; from the latter: ore valued at \$697,065, and 859,490 ozs. of silver bullion. In November an important strike was made upon the 1,500 ft. level of the Ontario. The Daly has been erecting a refinery for the reduction of its sulphides, which it is expected will result in a considerable saving. The Crescent and Anchor companies have made shipments of ore and concentrates, but have been engaged principally upon exploration and development work, especially the latter, which has been driving a long working and drainage tunnel, now completed. The Glencoe is a new producer, but not a large one as yet. Important new work has been undertaken in the district during the year, in the exploration of the Meears and Daly West properties.

At Tintic the Eureka Hill, Bullion-Beck & Champion, Centennial-Eureka and Mammoth have continued to be the largest producers. All of them have paid large dividends during the year, but the two first named being close corporations the amount of their payments has not been made public. Developments in the mines of both these companies have been very satisfactory, proving that the ore bodies of the Tintic district continue to be of good grade and strength with depth, and their shipments have been large. Large ore bodies have been discovered in the Caroline mine, adjoining the Bullion-Beck & Champion, and operated through the latter, and this property has also become an important shipper. The Centennial-Eureka Company has had the best year in its history, bodies of exceedingly high grade ore having been discovered in the mine, and its dividend payments show a decided increase. Mammoth did not keep up to its record of 1890; after paying regular monthly dividends for the first six months of the year, amounting to \$240,000, the mine was practically shut down, and ore shipments and dividends suspended. A new plant of machinery having been installed, ore shipments were resumed in the autumn, and the seventh dividend of the year was paid in November. Several new and promising strikes were made in the district during the year, but so far, none has developed into an important producer.

In the Bingham district the year has also been a prosperous one, although several of the most important properties have been idle on account of long-standing litigation. The Lead mine and the Old Telegraph have been regular producers, as have also the Maxfield and the Petro, both of which have paid dividends. A consolidation of many of the important mines of Bingham Cañon, under the title the Niagara Mining and Smelting Company, has been considered, but the deal does not seem to have been consummated yet. The famous old Emma and Flagstaff mines, at Alta, have been worked in a desultory manner without results of importance.

The receipts of ore and bullion in Salt Lake City, Utah, for the 11 months ended November 30th, 1891, were as follows:

	Bullion.	Ores.	Total.		Bullion.	Ores.	Total.
January.....	\$382,480	\$351,124	\$733,604	August.....	464,018	565,843	1,029,861
February.....	407,918	298,009	705,927	September ..	634,783	493,931	1,128,715
March.....	274,077	318,789	592,866	October.....	528,684	557,680	1,106,364
April.....	340,528	276,651	617,179	November.....	505,035	484,556	989,592
May.....	539,353	298,184	837,537				
June.....	446,798	457,350	904,148	Total.....	\$4,873,253	\$4,554,786	\$9,428,039
July.....	349,659	432,768	782,427				

WASHINGTON.

From our Special Correspondent.

Coal.—At present the coal industry in Washington is in the most flourishing condition, having passed from the prospect stage to active exploitation and large production. The mines of the Northern Pacific at Roslyn can produce 3,000 tons daily, while the mines at Carbonado ship as much as 1,000 tons daily, all going to the Southern Pacific system. The coal field seems to extend under the entire State from north to south and west of the Cascades. The coals are of recent origin. In some places they are only a fair quality of brown coal; in others a very good quality of black and shining bituminous steam coal. Many of these coals make a very fair coke, but as the best coking coals are bony and high in ash, they require washing to make a good article and to reduce the phosphorus, which is high for a steel-making coke. At Wilkeson they are said to be turning out a good quality of coke.

On the high flanks of the Cascades are several workable seams of coking coals near the Snoqualmie Pass, waiting railroad facilities for development. These seams extend along the west flank of the range south to Palmer, on the Northern Pacific Railroad. At Durham an English company has expended \$250,000 in buildings, brick-works and mine openings, but these are now lying idle, because the company finds that its coal, where opened, is too dirty to use without washing, and as it has neither coke ovens nor washing plant, it is neglecting, for want of a little more grit and capital, what might be built into a good paying business. Two new mines, located farther up this branch road, are shipping coal to the Northern Pacific Railroad, which will eventually be extended to the Snoqualmie and open all this belt.

The extent of the Roslyn seam on the west side of the mountains is already known to be large, and probably this field will prove very much greater by future development. The coal is of a very good quality, but no coke is made there as yet. At Whatcom the coal is said to be of excellent quality. A rich Montana firm has bought some of the Blue Cañon coal lands and is preparing to open up the mines on a large scale. Messrs. Hauser and Holter, of Helena, are among the owners.

At Gilman some of the mines are shipping a fair quality of lignite coal. There are at least sixteen places in the State, from Whatcom, in the north, to Centralia, in the south, where coal is being developed and shipments are being made.

Gold and Silver.—There are four districts attracting attention just now, Silver Creek, on the west side of the Cascades, and Monte Christo, Okanogan, and Cle-Elum on the east side. All the claims of these districts are prospects rather than mines. At Silver Creek and Monte Christo there are many promising claims that are being worked this winter. At present these mines are reached by very hard trails, so that nothing but a grade of ore of several hundred dollars per ton can be shipped out at a profit. The ores are galenas, with other base metals, the former running from \$60 to several hundred dollars in silver and a little gold, while the mixed sulphide ores run from a few dollars to about \$60. Many claims show nothing but large veins of arsenical pyrites on the surface, and a good deal of development will be required to determine the value of such claims. As these mountains are very steep there is a good opportunity for development by tunnels, and many are being driven to prospect the ledges during this winter. The ledges are large and strong, and already show immense amounts of low-grade base sulphures.

A gold mill will soon be in operation on the Teanaway at one of the claims which has done very well with an arrastra. A small quantity of gold is being washed from the placer ground on the Swank and Yakima, a few large nuggets being found. In the northeastern part of the State some fine gold prospects have been found, and many claims are changing hands at increased values. The specimens shown are especially fine.

The country of the Cascades is a difficult one to prospect in on account of the heavy growth of timber; therefore there is much promising territory still to be examined with every promise of success. Still, the showing is very good for so little development, although like every new district too large prices are asked for mere prospects, and there is practically no production as yet, except, to increase the ore dumps. Many prominent experts from California and the Eastern cities have been on the ground, and several well-known mining men have purchased properties, but as a rule the development does not warrant the prices asked. Increased activity may be looked for in the spring through all the mining districts.

Iron.—The only iron mines that are really being worked are those in the neighborhood of Port Townsend, but as the furnace is supplied largely from Vancouver, the quantity is undoubtedly small. The State is especially rich in iron ores of the magnetic variety, the Denny mine at the Snoqualmie Pass being the best, both in richness and purity, but those of the Cle-Elum Lake district are not very far behind in richness. These ores are apparently identical and of the same age geologically as the ores of the Island of Elba. There is no production of these ores yet, all the work being simply development. The deposit differs so much in quality that although found over a great extent of country but a small part of the field now known will produce ores suitable for steel making.

BELGIUM.

By Victor Watteyne, M. E.

The year 1891 has been for the coal industry of Belgium like a gloomy day following a fine day. The results of the year 1890 were exceptionally favorable, especially if compared with the long period from 1876 to 1887, preceding. After the never to be forgotten years 1872 and 1873 had elapsed came a long, hard era of decline and crisis, with only here and there small improvements. The crisis did not burst out suddenly, however. The year 1874 was still a good one, and 1875, and even a part of 1876, were tolerable, but the situation became worse and worse. The total output of our collieries was not indeed generally reduced; it was, on the contrary, several millions of tons greater at the end of the bad period than it was in 1873, but the profits were trifling in comparison with the capital invested, and sometimes were wiped out entirely. The decline in the industry was so steady that the situation seemed to be the normal one, and there was not much hope of prosperous years again, when, at the end of 1887, a favorable turn took place. The improvement was slow, but continuous, in 1888; it was more accentuated in 1889; and in 1890 the prosperity of our coal mines increased rapidly and the summit was reached, not so sharp indeed as that of 1873, but comparable with the latter.

The following table illustrates and summarizes the condition of the industry for the 20 years from 1871 to 1890:

PRODUCTION OF COAL IN BELGIUM.

Table with 8 columns: Year, Output (Tons), Value (Francs), Value per ton (Francs), Profits (Francs), Profits per ton (Francs), No. of workmen, Annual wages (Francs). Rows range from 1871 to 1890.

* The franc is equivalent to 19.3 cents. † Loss.

As for the year 1891, we have not yet the official statistics, but we can nevertheless give some reliable figures. The following table is the comparison between the output during the first six months of this year and the output during the first six months of 1890. In the former period there were 130 collieries worked, which made an output of 9,094,389 tons, while in the latter the number of collieries worked was 131, and the output 10,082,915 tons. The stocks at the end of the first six months of 1891 were 481,945 tons, and at the end of the first six months of 1890, 391,152 tons.

The exports of coal and coke for the first 10 months of 1890 and 1891 were as follows:

Table comparing exports of Crude Coal, Brioquettes, and Coke for 1890 and 1891 across various countries including Germany, England, France, Luxembourg, Netherlands, and others.

SUMMARY OF EXPORTS.

Summary table of exports for 1890 and 1891, showing Coal, Coke, and Brioquettes in tons.

* Estimated.

The imports for the first 10 months of 1890 and 1891 were as follows:

Table comparing imports of Crude Coal and Coke for 1890 and 1891 across Germany, England, France, Netherlands, and others.

† Coming from England or from Germany.

SUMMARY OF IMPORTS.

Summary table of imports for 1890 and 1891, showing Coal and Coke in tons.

* Estimated.

From the figures which have already been given and from the statements that I am receiving directly from the managers and owners of our

coal mines, it can be safely estimated that the total production of the Belgian collieries in 1891 will be about 19,300,000 tons.

The prices have been subject to many important fluctuations during 1891. The general tendency has been for lower prices, but several circumstances have prevented them from falling very much. The strikes were among these circumstances, and the recent one which took place in France (Pas de Calais) made the value of the coal rise in our country. But now the strike being over and the winter as mild as possible, prices will rapidly fall again. As a provisional figure, it may be said that the average price per ton will be in 1891 about 1 1/4 fr. lower than the average price in 1890, and that the total value of the production of our coal mines in 1891 will be about 224,000,000 fr., with an average price of 11 fr. 60 c. per ton.

As I said at the beginning of this article, 1891 is like the day following a fine day. If a careful review is made of the progress and the fluctuations of our coal industry for a long train of years, it can not be denied that the period 1889-90 presents a remarkable analogy with the period 1872-73, with less intensity of course, for a very important factor was in action in 1872-73 (the consequences of the Franco-German war), which was absent in 1889-90. But besides the accidental causes, as material as they may be, there is a kind of law in the history of the industry. Going on with the analogy, I dare say that 1891 may be compared with 1874. If it be so, and I hope I mistake, we have very much to fear for the period to come, and it may be that this century will be ended during a period of crisis and of industrial decline not very different from the period 1876-77.

To get an exact idea of the situation of our coal mining industry, it must be observed that the conditions in which the coal is mined in Belgium are not so easy and advantageous as in many other countries. The thickness of the beds is small, and the depth at which these beds have to be worked is very great, and more and more increasing, involving more and more difficulties and danger, for the mines are more fiery and dusty as greater depth is attained. In the Hainaut, the most important mining province, there are now 185 pits; 37 of them are from 600 to 700 meters deep, 22 from 700 to 800 meters, 14 from 800 to 900 meters, and 4 from 900 to 1,000 meters. In the pit Ste. Henriette of the Charbonnage des Produits, they are now working at the depth of 1,160 meters (3,850 ft.)

As for the thickness of the seams: in the Borinage, the district where the mines are the most numerous and deep, the average thickness of the seams is only 0 m. 56 (1 ft. 10 in.) A consequence of such a situation is that the output per workman employed is not so great as in the other countries. M. Ingenieur en Chef Em-Harzé gives in his last statistics, just published, a table where the average output is compared between several European countries. I take from that table the following figures:

Table comparing average annual output, number of workmen, and annual output per workman for Belgium, France, Germany, and England in 1871-80 and 1891-90.

Among the constantly increasing difficulties that the owners and the managers of our coal mines have to overcome must be mentioned the strikes, which become more and more frequent and extensive. The strike that followed May 1st in this year lasted 76 days in the district of Charleroi, where 28,500 workmen are employed in the coal mines.

I have gathered from official sources the number of accidents that took place up to December 10. If we suppose that no accident with numerous victims (explosions of fire damp, etc.) shall accrue from to-day till the end of the year we can complete the table by adding the average number of accidents that happen in the second part of December, and we can say that the total number of accidents in the Belgian coal mines has been in 1891 as follows: Numbers of accidents, 190; workmen killed, 163; severely wounded, 68. One of these accidents took place September 19 at the pit No. 8 (Forchies) of the Charbonnage de Monceau-Fontaine, near Charleroi; 27 workmen were killed by an explosion of fire-damp.

I am indebted to recently published statistics of M. Harzé for the following interesting table showing the number of workmen killed in the coal mines of Belgium and the surrounding countries during the period 1881-90 in comparison with the total number of workmen employed:

Table showing the number of workmen killed in Belgium, France, Great Britain, and Prussia from 1881 to 1890, including average annual figures.

CANADA.

By John Stewart, M. E.

A notable feature in connection with the mining industry in the Dominion of Canada during the past year has been the measures passed in the local Houses of Assembly, in the Provinces of New Brunswick, Quebec, Ontario and British Columbia. These enactments have an important bearing on the future of the industry in two ways; in the opposite directions of promoting the mining interests or in retarding them. The former consists in the recognition of the true principle, that the mining rights are separate and apart from the surface or agricultural rights. The minerals belong to the people, and their representatives are intrusted to grant the working of them to the miner or to those who are willing to invest capital in exploiting them. The possessor of the surface formerly owned everything beneath the boundaries of his land and the underground boundaries were the surface lines of the property produced vertically under the surface lines. The old system has prevented mining, and only worked in the interests of the speculative tendency of a surface owner who sat on his mining claim and demanded a cash sale for minerals the existence of which he could not guarantee. The new enactments are more in keeping with those of the United States or British Crown Lands.

duced about 150 tons a month, with 30 to 40 men, and 1,000 tons were mined up to July; the mine was closed down in the fall. The Kingston Mining Company averaged 100 to 150 tons per month during the year. Prospecting has been done in the Sharbot Lake and Oso districts on the line of the Kingston & Pembroke Railway.

Iron.—A company was organized by Mr. T. D. Ledyard, of Toronto, called the Belmont Bessemer Ore Company, of New York, to work an iron mine in the township of Belmont. A shaft has been sunk 50 ft. and crosscuts driven. A diamond drill has been used on the property to a depth of 100 ft. to 300 ft., proving the deposit to be 60 ft. to 70 ft. wide, at least. The company proposes to build a spur 6 miles long to the line of the Canadian Pacific's Ottawa & Toronto division. A force of 20 men are employed under the superintendency of Mr. G. L. Wardworth, M. E., late of the Iron River mine, Michigan. A few hundred tons of magnetic ore are reported to have been shipped from the Snowdon district. Prospecting and considerable booming of iron claims have been carried on in the Thunder Bay iron ranges west of Port Arthur.

Gold.—Mr. J. McFee, Belleville, Ont., organized the Crescent Gold Mining Company of Marmora, Limited, to work the old Gladstone and Feigle mines, near Malone, Marmora Township. A new discovery of gold bearing quartz was made this season in Belmont Township, and Mr. Mark Powell, of Marmora, and Mr. J. Lingham, of Belleville, organized a com-

MINERAL PRODUCTION OF THE DOMINION OF CANADA.

PRODUCT.	1885.		1886.		1887.		1888.		1889.		1890.		
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
Antimony ore.....tons	756	\$3,250	665	\$31,490	584	\$10,860	345	\$3,696	55	\$1,100			
Asbestos....."	2,440	142,441	3,458	206,251	4,619	226,976	4,405	255,007	6,113	426,554	8,000	\$1,039,661	
Baryta....."											1,842	7,543	
Bricks.....thousands			139,345	873,600	181,581	986,680	190,201	1,020,578	200,561	1,273,884	208,587	1,247,677	
Building Stone.....cu. yds			165,777	642,505	267,592	552,267	302,324	708,418	341,337	913,691	360,001	939,168	
Cement.....bbls					69,843	81,909	50,668	35,593	90,474	69,790	102,216	92,405	
Charcoal.....bush			904,500	54,000	1,610,900	88,823			1,593,300	93,463			
Coal.....tons	1,951,976	3,817,225	2,091,976	4,017,225	2,368,891	4,757,590	2,658,134	5,259,832	2,719,478	5,581,182	3,117,661	6,396,910	
Coke....."			35,396	101,940	40,428	135,951			54,539	155,013	66,450	166,298	
Copper, contained in ore.....lbs	2,805,000	283,300	3,305,000	354,000	3,260,424	342,345	5,562,894	723,172	6,809,752	885,424	6,454,913	988,241	
Feldspar.....tons											700	3,500	
Fertilizers....."					498	25,943	600	22,400		775	26,696	1,203	31,889
Fire Clay....."										460	4,800		
Flagstones.....sq. ft			71,000	7,873	116,000	11,600				14,000	1,400	17,865	
Glass and Glassware....."								375,000			150,000	537,130	
Gold.....oz	74,338	1,116,023	76,879	1,330,442	66,270	1,178,637	61,310	1,008,610	72,378	1,295,159	65,014	\$1,166,227	
Granite.....tons			6,062	63,300	21,217	142,506	21,352	147,305	10,197	79,624	13,307	65,985	
Graphite....."	Not given.		500	4,000	300	2,400	150	1,200	242	3,160	175	5,200	
Grindstones....."			4,020	46,545	5,292	64,008			3,404	30,863	4,884	42,340	
Gypsum....."	117,000	122,340	162,000	178,742	154,008	157,277	175,887	179,393	213,273	265,208	226,806	193,527	
Iron....."					31,527	1,087,728			73,231	2,763,062	71,772	331,688	
Iron ore....."	69,520	115,458	69,708	126,982	76,330	146,197	78,587	152,068	81,181	151,640	76,511	155,380	
Lead contained in ore.....lbs					204,800	9,216	674,500	27,472	165,100	6,604	113,000	5,085	
Lime.....bush			1,535,950	283,755	2,369,087	394,859			2,948,249	362,848	2,218,413	364,425	
Limestone for flux.....tons					17,171	17,500				22,122	21,900	17,913	
Manganese ore....."	1,950	48,843	1,789	41,499	1,245	43,658	180	47,944	1,456	32,737	1,328	32,550	
Marble....."			501	9,000	242	6,224			83	980	780	19,776	
Mica.....lbs	Not given.		*20,361	*9,008	*22,083	*29,816	*21,851	*21,127	*36,529	*28,718		68,074	
Mineral paints.....tons			8,614	46,220	100	1,500			794	15,280	30	5,500	
Mineral water.....gals							124,850	11,456	424,600	37,360	417,165	35,231	
Miss. clay products....."				112,910		182,150				230,385			
Moulding sand.....tons					160	800	169	845		170	850	170	
Nickel.....lbs											1,336,627	1,002,470	
Petroleum.....bbls			486,441	437,797	763,933	595,868			639,991	612,101	765,029	902,734	
Phosphate.....tons			20,495	304,338	23,690	319,815	22,485	242,285	30,988	316,662	31,753	361,045	
Pig iron....."			22,192	237,768	24,827	366,192			25,921	499,872			
Platinum.....ozs					1,400	5,600	1,500	6,000	1,000	3,500	1,000	4,500	
Potttery....."												190,242	
Pyrites.....tons	31,123	149,054	42,906	193,077	38,043	171,194	63,479	285,656	72,225	307,292	49,227	123,085	
Salt....."	33,782	183,888	62,359	227,195	60,173	106,394	59,070	183,460	32,837	126,547	185,382	185,382	
Sand and gravel (exports)....."			646,552	143,641		6,224			283,044	52,647	342,158	65,518	
Silver.....ozs			209,090		349,330		395,377	383,318	343,848	400,687	420,687		
Slate.....tons			5,345	61,675	7,357	89,000	5,314	90,689	6,932	119,160	6,388	100,250	
Soapstone....."			50	400	100	800	140	280	150	1,170	917	1,222	
Sewer pipes....."												348,000	
Steel.....tons					7,326	331,199			27,873	973,282			
Sulphuric acid.....lbs					5,476,950	70,609	8,728,220	121,515	10,998,713	152,592	11,118,779	145,235	
Terra Cotta....."												50,000	
Tiles.....thousands			12,416	142,617	14,658	230,068	12,102	171,400	10,526	134,254	10,265	140,177	
Estimated products....."				156		1,614,069				992,338		1,349,018	
Arsenic....."	440		120	5,460	30	1,200							
Whiting.....lbs											500	500	
Totals				\$10,529,361		\$15,000,000		\$16,500,000		\$19,500,000		\$19,000,000	

*Exports. †Nova Scotia gold is calculated at \$19.50 per oz.; and that from British Columbia at \$17 per oz.

The objectionable features in them will be amended in time, but their general tendency is in the interests of legitimate mining and the welfare of the miner.

ONTARIO.

Apatite—The Anglo-Canadian Phosphate Company resumed mining in the spring at Otty Lake, in the Perth district, with a force of 30 men, and continued working until October. The Bobs Lake mines, owned by this company, have been worked on contract. Many small openings are worked yearly by prospectors and farmers in the Kingston and Perth districts. Messrs. Brodie & Co.'s superphosphate works at Smith Falls are in operation, and receive their supply from small producers along the Rideau Canal.

Prospecting has been carried on in the northern phosphate district from Haliburton and Monmouth townships on the west through the northern part of North Hastings County to Sebastopol and Brudenell townships. Deposits 10 ft. wide are reported to have been discovered near Cobden Station, on the line of the Canadian Pacific Railway, in Bromley Township.

In the Kingston district the Rock Lake phosphate mine on lot 21 in 15th con. of Storrington has been leased for ten years by James Bell, of Amprior, and Lomer Rhor & Co., Montreal; 100 tons a month are agreed on as the minimum output. The Blessington Mining Company closed down the Silver Lake, St. George's Lake and Bedford mines during the early part of the year, but continued to operate two shafts at the Eagle Lake mine with a force of 30 men. Operations were resumed in the summer and several thousand tons of rock were mined. The Foxton mine pro-

pany in England to develop the find, which is reported to be rich, and has caused some excitement in the district. A stamp mill is being erected. A shaft has been sunk over 60 ft. and the ore is said to yield \$18 a ton. In Creighton Township, Sudbury district, on lot 10 in 4th con., development work has been done, and on lot 2 in 4th con., Messrs. Clark & Co. have sunk a shaft 60 ft. A new company has been formed to work the Vermillionmine on lot 6 in 4th con., Dennison, for gold, platinum and nickel ores.

Copper and Nickel.—Little or no ore has been mined in the Copper Cliff mine, the old stock piles, with ore from the other mines, having been used for a supply for the roasting yards. The two cupola furnaces were in blast producing copper-nickel matte. An extensive Bessemer plant has been constructed during the past season and operated. The Evans mine, 1½ miles southwest from the Copper Cliff, has been worked during the year. The Stobie mine, 3½ miles north of Sudbury, has also been a steady producer.

The Dominion Mineral Company's Blizzard mine, four and one-half miles north of Sudbury, was worked until October, when it was closed down with a view of reorganizing the company. One blast furnace was operated and matte shipped to England and the States. A force of 300 men were employed.

The Worthington mine near White Fish Station, on the Algoma branch of the Canadian Pacific Railway, was in operation all the summer and produced some rich ore, said to carry 30% nickel, which was shipped to Joseph Wharton, of Philadelphia. A force of 35 men was employed at this mine. The Crean mine, near the Worthington mine, is reported to have produced a little ore.

Messrs. H. H. Vivian & Co.'s Murray mine, 3½ miles northwest of Sud-

bury, on the main line of the Canadian Pacific Railway, has been worked during the year, and has made regular shipments to England. An extensive plant has been constructed.

Mr. R. P. Travers organized the Chicago Nickel Company, to work the Travers mine on lot 3 in 5th con., Drury Township, early in the year. Mining operations have been actively carried on by this company, and a cupola furnace erected which was blown in in October. The company has also done some development work on lots in the 1st con. of Trill Township. The Algoma Nickel Company, organized by Chicago capitalists to work deposits on lot 11 in 5th con., Lorne township, has done development work and commenced extensive operations for roasting and smelting. The company is well situated for such operations. In the township of Levack, about 20 miles west of Sudbury, an English syndicate under Professor Huntington, of London, has spent several thousand dollars in development work, under the management of Mr. A. Merry, lately with H. H. Vivian & Co. Other owners have done work in the district with a view to effect a sale or form a company.

The adoption of nickel-steel for armor plates by the United States Government had the effect of causing the large stocks of several thousand tons (about 5,000) of copper-nickel matte to be sent from Sudbury to the refiners in the States during the summer. The balance of the product of the district in rich ore and matte was sent to England and Europe and amounted to about 885 tons.

Silver.—The Badger mine, in the Port Arthur district, has been worked extensively during the year, but the mill was under repairs in the spring. A tramway was built between this mine and the Porcupine. From 65 to 75 men were employed. The Porcupine, which is under the same management as the Badger, has also been a steady producer during the year. At the Beaver mine an addition of 10 stamps was made to the mill in the early part of 1890, and regular shipments have since been made. The East End Silver Mountain resumed work with a small force in October, and 10 barrels of silver ore were shipped in November. The West End Silver Mountain has produced richer ore and in larger quantities than heretofore, and continuous shipments of high grade ore were made.

At the Murillo mine the shaft was unwatered and a contract let to sink 100 ft. The plant is now advertised for sale. The Climax, a new mine adjoining the Porcupine, has been opened. Two promising veins have been found, producing good mill ore and high grade shipping ore. The mine is owned by Port Arthur people and is under bond to an American company. The Palisades mine, which is located north of the Beaver, is producing rich silver ore. Rich ore is reported to have been found by Henry Parsons on lot 19 in 2d con. of Paipoonce Township, 10 miles west of Port Arthur. The ore is rich in native and black silver. At Arrow Lake, the main shaft of Winchell-Middaugh mine, when down about 80 ft. and in good ore, was stopped on account of water. At the Augusta mine 12 men were employed. A drift was driven to cut the vein at 160 ft. Some prospecting was done in the district. The reduction works at Rat Portage are reported to have been completed, but have not yet commenced operations.

QUEBEC.

Asbestos.—During the early months of the year heavy snow and short supply of water retarded work at some of the quarries, locally called mines.

Almost all the mines in the Thetford and Black Lake districts were closed in the fall on account of the action of the Quebec legislature in passing the new Mining Act, which contains several objectionable clauses and imposes a 3% tax on the mineral output of the Province. Notwithstanding this stoppage of work, the total year's output has been a large one, and will be in excess of that of last year. A notable feature of the year has been the increase in price, as in November \$200@\$225 was asked, first quality, \$75@\$100 for second, and \$30@\$50 for third. This was due to the producers combining to hold their products for higher prices.

Mr. W. H. Jeffrey, who for years has been the only producer of asbestos in the Danville district, the first district where asbestos was discovered, has put in steam hoists and drills, having purchased the whole rights in the property, and as a result has greatly increased the output above all former years. This action has stimulated prospecting in this district and several properties are reported to have been sold.

In the Templeton district, Ottawa Valley, Mr. W. A. Allan developed an asbestos property on lots 15 and 16, 5th Range, Portland West, during the summer. The fiber is fine and silky, and 67 bags of various grades have been shipped. The Templeton Asbestos Company, under Mr. C. Koenig, operated the Ferrans mine; shafts have been sunk about 100 ft. and levels driven, about fifty men being employed. Good veins of asbestos have been found in the workings.

In the township of Litchfield, in Pontiac County, Ottawa Valley, Laurentian asbestos has been found and prospected during the summer. The asbestos and the serpentine-limestone rock in which it occurs are similar to those of the Templeton district.

Copper.—Owing to the high price of brimstone in the early part of the year the entire output of the Capelton mines was shipped and the smelting plant of the Eustis Mining Company was not operated. The production of matte from the lower grade of pyrites has been of small amount. Messrs G. H. Nichols & Co. have operated their sulphuric acid plant and superphosphate works, besides shipping ore to the United States. A syndicate of Cleveland, O., acid manufacturers has done extensive development work in the district north of the St. Francis River on the Howard and Moulton Hill mines and shipped ore to their works in the West, but operations were discontinued during the fall. About 80,000 tons of pyrites have been produced in the Capelton district during the year. The Leeds Copper Company, Limited (capital £450,000), was formed in May, being an reorganization of the late Excelsior Copper Company, and has worked the Leeds copper mine (the old Harvey Hill mine). A crushing and concentrating plant and blast furnace have been erected and operated during the year, but some difficulty has been experienced in obtaining the proper flux for the blast furnace. How the small output from this mine is to bring dividends on the large capital is as yet an unsolved problem for the new directors of this undertaking.

Gold.—In the Chaudiere district no alluvial washing has been done this summer, as parties interested are waiting until next year, when the old seignioral rights expire. Some prospecting was done in this district during the autumn and also in the Ditton district near Sherbrooke. At Campbell's Bay, in Litchfield Township, Ottawa Valley, quartz veins holding free gold are reported to have been found during the last season and have been prospected. The occurrence is said to be similar to the Malone ore in Marmora, Ont.

Slate.—The New Rockland slate quarries and mill in the Richmond district have been operated throughout the year with a force of about 200 men, and it is proposed still further to extend operations and open that part of the property, to the south of the present workings, known as the Prince Albert quarry. The Bedard quarry has been closed for want of sufficient capital to continue development. A vein of purple slate has been opened near Brompton Lake during the season. It is soft and well adapted for mill stock for mantles, etc. The market supply of slate and slate materials is not equal to the demand.

Apatite.—Some activity was manifest in the Templeton district during the early part of 1891, as the product of these mines can be more easily hauled on sleighs in winter than during the summer season. Among the properties operated are those of the East Templeton District Phosphate Syndicate, which has opened two shafts on a 4-ft. vein. The MacLaurion Phosphate Mining Syndicate, working 40 men, has produced 150 tons a month. The North American Company, with a force of 15 men, has averaged 150 tons a month. The largest output has been from the old Blackburn mine, which is now owned by Messrs. Lerner, Rohr & Co., a force of 100 men produced about 500 tons a month in the early part of the season, which was increased to 700 tons a month in the fall. The old Jackson Rae mine, on west half of lot 9, in 10th Range, was operated by Fee & McDonald, of Ottawa, and 8 cars of No. 1 phosphate were sent to Liverpool in July. Messrs. MacLaurin purchased the Charlotte lots, in the 11th range Templeton, 300 acres, for \$5,000. Mr. James MacLaurin, with 30 men, is working the north half of lot 8 on the 12th range. Messrs. Hector, McRae & Co., of Ottawa, have used a diamond drill on their property, lot 11, in the 5th Range Templeton, and a plant of Ingersoll steam drills, hoists, boilers, pumps, derricks, etc., was erected. Three hundred tons of phosphate were mined in July, and an electric plant for lighting and operating hoist and drills was installed. This company worked the old Fidelity mine on lot 12 in range 11, and prospected other lots in this and adjoining townships. Mr. James Cooper, president of the Ingersoll Rock Drill Company, of Montreal, organized the MacGregor Lake Phosphate and Mining Company, Limited, in Glasgow, Scotland, to work the Benson property, but work was suspended in July. The General Phosphate Corporation, Limited, worked the Murphy property and shipped 300 tons by barge to Montreal and 80 tons in August. Mr. C. B. Falardean has worked the old Canada Industrial Company's property (the old Post mine on the east half of lot 9 in range 10) with a force of 25 men. Several hundred tons have been shipped, and 50 tons a month have been mined during late months of the year. The Fleming Phosphate Company has done development work on lots 26, 27, 28, 29 and 30 in range 4, Portland West, and discovered large deposits of both red and green phosphate of high grade. This property is capable of extensive operations and large output, when the market warrants construction of the necessary plant and tramroad to shipping points. The Netherlands Company worked two pits on lots purchased from the Templeton & Blanche River Company during the year with a force of 40 men, and made a satisfactory output. Messrs. Fissault & Lapage, on their lots in range 4, employed about 22 men. A. F. McIntyre, of Ottawa, prospected lots 4, 5, 6 and 7 in the 2d range, Masham Township, near the Peche village and one mile from the Gatineau Valley Railway, which is now constructed to this point. A deposit of workable extent has been developed in the property although it was given up by a prior prospector. At the old Gow mine in Hull Township a workable deposit of phosphate was discovered in working the amber mica on this lot. It will be developed next season. Twelve companies and individual operators were at work in this district during the year, and considerable prospecting has been done in this and adjoining townships.

In the Buckingham district the Phosphate of Lime Company's mine at High Rock has produced about 600 tons a month, with 175 men employed. In July new ground to the northwest of Cap Rock pit was opened. At present 50 men are employed. The Canadian Phosphate Company operated the Union mine during the season. The Central Lake Mining Company was formed by Mr. S. P. Franchot and Capt. Macnaughton, of Buckingham, and American capitalists to mine phosphate on lots 7, 8, 9 and 10 in range 10, Portland West. About 1,000 tons were hauled while the sleighing lasted, and mining progressed during the season. The General Phosphate Corporation, Limited, has operated the High Falls and Ross Mountain mines and constructed plants at both mines, the want of which has necessarily curtailed the output hitherto. At the Ross Mountain mine a bedded deposit of phosphate was discovered on the east or river side and was worked. The first shipment of 600 tons was made in May to Hamburg. Mr. S. P. Franchot, with American capitalists, has organized the Emerald Mining Company to work the old Emerald mine of the Ottawa Mining Company. The Dominion Phosphate Company operated the North Star and Washington property near the Emerald mine. The Little Rapids mine was worked with a small force by W. A. Allen, the owner. The Anglo-Continental Guano Works Company worked the Etna and Star Hill mines during the year. The Dominion Phosphate Company, Limited, suspended work at the London mine near Little Rapids in May.

The majority of the phosphate mines are closed for the winter on account of the local government placing a royalty of 3% on the output of all minerals, and are awaiting the results of the passing of the bill or the petitions to have it disallowed. The High Rock with 50 men and the High Falls with 90 men are the only mines at present being worked. The locks at Little Rapids were completed this fall and the dam is to be constructed this winter, which will raise the water 12 ft. and give uninterrupted navigation from Little Rapids to the High Falls and greatly benefit the mines on the upper part of the river.

The shipments of phosphate rock from Montreal during the season of 1891, as per Custom-House manifests, aggregated 14,009 tons, as against

21,762 tons in 1890. The shipments each year were distributed as follows:

Destination.	1890.	1891.	Destination.	1890.	1891.
Liverpool.....	11,103	6,972	Queensdown.....	84	650
London.....	4,446	2,755	West Hartlepool.....	.....	300
Hamburg.....	2,805	840	Cardiff.....	.....	284
Glasgow.....	1,752	1,411	Bristol.....	.....	187
Hull.....	820	60	Leith.....	.....	150
Grimsby.....	422	125	Antwerp.....	.....	50
Newcastle.....	200	225	Fleetwood.....	.....	.....
Swansea.....	130	.....		21,762	14,009

Graphite.—The property in the Buckingham district owned by Mr. Walker, a lawyer of Ottawa, has been operated to a small extent during the year, with a view to effect a sale, which did not, however, materialize and the mine quit work as the pay was behind. Another graphite property near Donaldson's Lake has been operated by Mr. Jacob Weart, president of the Graphite Lubricating Company, of Jersey City, N. J. and a new process and plant employed with, it is said, satisfactory results. Shipments of dressed graphite have been made from this mine.

Iron.—The Bristol iron mine near Ottawa has been leased on royalty for a term of years by Messrs. Ennis & Co., of New York. The engine house was destroyed by fire in April and was rebuilt with the addition of two roasting kilns, crushers and elevator, which gives the plant a capacity of handling 100 tons of ore per day. The mine closed down in July with 10,000 tons of ore on hand. This ore is mined for export to the United States. There are two companies operating charcoal blast furnaces in the Province of Quebec at present, both using bog ore and producing car-wheel pig iron. These are the Canada Iron Furnace Company, Limited, at Radnor, near Three Rivers, which uses local ores and manufactures for the Canadian Pacific Railway, and Messrs. John McDougall & Sons, at Drummondville, who use ores from the Ottawa Valley and manufacture for the Grand Trunk Railway.

Lead.—The Galena mine at Lake Temiscamingue produced about 175 tons of concentrates assaying 16 oz. silver per ton and 70% lead during the year. The first shipment of 75 tons was made to the Balboch Smelting and Refining Company in January. The shaft was sunk 25 ft. during the winter and at 125 feet water was struck in such volume that the mine was closed down in March. Drifts had been driven at the 100-ft. level and the mine at this depth was practically valueless.

Mica.—In the phosphate districts of Kingston and the Rideau Canal, in eastern Ontario, and in the Templeton district of Quebec a large number of properties have been worked for amber or colored mica for the use of electrical manufacturers. This class of mica is found associated with phosphate veins, at times occurring on the walls, and at times forming the whole vein filling. It is exported to the United States and England, both in the rough and in cut and split forms. Statistics of output are not obtainable at present, as the shipments are made in small lots.

BRITISH COLUMBIA.

(By George E. R. Ellis, M. E.)

Considerable progress has been made in mining in British Columbia in 1891, but not nearly to the extent foretold by many. Owing to its proximity to the United States boundary, the southern portion of West Kootanie, including the Nelson, Hot Springs, Goat River, and Trail Creek camps, has been the center of interest.

Early in March the Silver King tunnel was connected with the wizen and a large quality of high-grade ore disclosed. Since then a depth of 230 ft. has been attained, at which level the cross cuts show the ore body to be both smaller and poorer. Several good offers have been made for the property, but in vain. No ore has been shipped, although hundreds of tons are lying in the ore houses. In proper hands this property would be a wonderful stimulus to the development of this district, but until the Ramsay interest acquires full possession no change from the present lukewarm style of working need be expected.

In April, J. E. Boss secured the Silver Queen, Grizzly Bear and Iroquois mines, and A. M. Esler partly purchased and partly bonded the Dandy, the west extension of the Silver King. The Stadacona Silver-Copper Company of Victoria was formed to work the Grizzly, and a tunnel has been driven from the east end, but the crosscut from it has not yet reached ore. The Iroquois and Silver Queen, to the regret of all, have been idle the whole year. On the Dandy solid work has been done; both ledges have been tapped at considerable depth, and if the grade of the ore is satisfactory the bond will be taken up. This work has proved the permanency of the Silver King ore body to a depth of 500 ft. to 600 ft. Unimportant work has been done on other Toad Mountain claims and many interests have been sold apparently to speculators, shoals of whom have been here this year.

The financial difficulties of Mr. Hussey have kept the Poorman mine and mill idle, and the neighboring gold properties have been consequently neglected. Further west, however, the Whitewater Company has made considerable progress, proving both the quantity and grade of its ore to be satisfactory.

In the Hot Springs camp much work has been done on the Skyline, Tenderfoot No. 1, United, Tam O'Shanter, Fourth, Neosho, Krao, Bellie, and others, and more undoubtedly would have been done were a suitable market available for its lead-silver ores. The establishment of the new 80-ton smelter on Pilot Bay, 10 miles away, will undoubtedly benefit the camp, for the enterprise is in able hands. During the year the Skyline ledge has been tapped at 200 ft., showing good ore and enough of it. New machinery has been placed on the Krao and Tenderfoot. Ore has been shipped from the No. 1, United, Tom O'Shanter, Fourth, etc., and new owners have been found for the Skyline, Krao, Maestro, Fourth, Old Timer, Neosho, Tam O'Shanter, Ellen, E. W. R., and many less important claims.

At Trail Creek the Le Roi Company, capital stock \$2,500,000, has kept a few men at work on the Le Roi and neighboring claims, but the progress made has been unimportant. The ore is very refractory and attempts are being made to treat it by some new electric process.

Coming to new discoveries, small quantities of rich copper and lead silver ores were found on Goat River, near the Kootenay, and rich free gold ore on Sheep Creek, near the Columbia; but little work has been done on either. More excitement was caused by the discovery of good copper and lead-silver ores on Kaslo Creek, 12 miles north of Hot Springs, and a town-site—Kaslo City—has already been laid out and partly sold. Following close on this came the discovery of the year, viz.: of high-grade

galena and carbonate ores, 6—11 miles east of the Slocan Lake, and the finding still later of galena and dry silver ores close to the lake itself. Practically no development has been done on account of snow, but the surface ore is rich and apparently is present in quantity. The district is unexplored and there undoubtedly will be a great rush thither from all parts in the spring.

As regards the outlook for 1892, Nelson is entirely dependent upon whether or not (1), the Dandy bond is taken up, and (2), a change occurs in the ownership of the Silver King; Hot Springs will rely chiefly upon its securing a favorable market for her ores; Trail Creek and Goat River will probably remain much the same as at present; while the Slocan District will stand or fall upon its merits, for it will certainly receive a full share of attention.

NOVA SCOTIA.

(By E. Gilpin, Jr., M. E.; H. M. Inspector of Mines.)

During the year 1891 the mining industries of this Province have shown little advancement of a startling character.

Coal.—The total output of the collieries for the year is 2,046,000 tons (2,240 lbs.), compared with 1,984,001 tons in 1889, the increase being absorbed in Nova Scotia and Quebec. The trade up the St. Lawrence continues to grow steadily, but that with the United States shows no improvement. The largest individual output was from the Springhill mines, being 461,000 tons. Many improvements have been introduced in the way of iron heapsteads, screens, ventilators, etc., and the Jeffrey and Ingersoll coal cutters are being installed into some of the Cape Breton mines, where the conditions are favorable for mechanical coal cutters. The outlook for next season's work is, so far as can be judged at present, encouraging, and efforts will be made to put all the pits in a position to give an increased output next year.

Copper.—The Eastern Development Company has continued opening its mine at Coxheath, and has now taken out several thousand tons of ore, but has not commenced regular mining. The amount of ore in sight would warrant the erection of smelting works, etc. Discoveries of copper ore have been reported from several localities, but little work may be expected before the Coxheath mines are started.

Gold.—From the returns so far received it is estimated that the total yield of gold this year will be 20,750 ozs., from 45,000 tons of quartz, etc. During the year a number of mines have been closed which had too much surface development, while a number of the older mines kept on working steadily. None of the yields were notable except one from Uniacke, where 60 tons of ore yielded 768 ozs. of gold. Some examination has been made into the question of alluvial mining here, and there appears to be good reason for considering the alluvium of many parts of the Province auriferous enough to warrant systematic testing.

Iron.—The furnaces at Londonderry have been run steadily on ore from the Cobequid mines, and from Torbrook, in the Annapolis Valley. The production of pig iron has been 19,800 (long) tons. The plant is being enlarged with a view to doubling the production next season. The New Glasgow Iron and Railway Company is about completing its smelting plant at Eureka, Pictou County, and has 12 miles of railway completed to its iron mines at Springville. It expects to be in blast next May. A charcoal iron furnace is being built by Pictou people in the same district. The total production of iron ore was 60,000 tons.

Manganese, etc.—There is little else to report. About 50 tons of manganese have been returned.

Plaster.—The quarries around Windsor, Hants County, have been kept employed, and the output from the province is about the same as last year, viz., 150,000 tons. Two quarries in Cape Breton have shipped several thousand tons to New York.

Summary.—The mineral production of the Province in 1891 may be summarized as follows: Coal, 2,046,000 tons, valued at \$3,069,000; gypsum, 150,000 tons, valued at \$127,500; iron ore, 60,000 tons, valued at \$120,000; manganese, 50 tons, valued at \$3,750; gold, 20,750 ounces, valued at \$406,700; total value, \$3,726,950.

MINERAL PRODUCTION OF NOVA SCOTIA IN 1889 AND 1890.

	1889.	1890.		1889.	1890.
Gold, ounces.....	28,155	24,356	Barytes.....	.....	.....
Iron Ore.....	45,907	51,191	Grindstones, etc. " ..	18,000	8,385
Manganese Ore, " ..	67	266	Molding Sand.. " ..	170	170
*Coal raised.....	1,756,279	1,984,001	†Antimony Ore.. " ..	55	26
*Coke made.....	35,565	36,738	‡Limestone.....	19,000	35,000
†Gypsum.....	147,344	146,003	Copper Ore.....	500	1,000

* Ton of 2,240 lbs. † Amount exported. ‡ Value in dollars.

GERMANY.

From Our Special Correspondent.

The general mining industry of Germany during 1891 does not show any salient features as compared with the preceding year. Spelter, the chief German metal, has continued to be under the control of a syndicate which restricts its output. There has been stability in the spelter market, and the syndicate is likely to succeed in maintaining this condition. The metallurgical industries have not been as busy as they were after the collapse of the copper syndicate. The feverish activity which then prevailed has subsided into a state abutting on the calm, and there have even been of late complaints of lack of orders from different German industrial centers. On the other hand, it is a fact that consumers, owing to the unaltered state of the copper market have accustomed themselves to buy from hand to mouth only, and this policy brings them into the market after every rise in the price of copper. The outlook for the future is a very uncertain one; the works are generally not possessed of many orders for forward delivery.

JAPAN.

Official Report to the Engineering and Mining Journal.

We are indebted to the courtesy of the president of the Imperial University of Japan for the official statistics of the mineral production of Japan in 1889. The statistics for 1890 have not yet all been officially reported. The values are given in yen; \$1.=1.328 yen on an average.

The weights and measures used in this table are as follows:—For gold and silver the denomination is the *momme*=57.92 grains=3.75 grammes. For cast and wrought iron, steel, iron pyrites, the *kan*=10.0646 lbs. The

kin = 14 lbs., is used for several substances. And for coal the English ton of 2240 lbs. For petroleum the liquid measure sho = 0.397 galls. is used.

MINERAL PRODUCTION OF JAPAN IN 1889.

METALS.	Product.	Sold, both for home use and export.	
		Quantity	Value.
Yen.			
Gold..... (momme)	204,939	206,253	471,637
Silver.....	11,458,137	11,801,826	1,778,581
Copper..... (kin)	27,090,181	26,091,591	4,261,696
Lead.....	1,002,834	986,468	70,900
Tin.....	88,006	99,451	29,529
Antimony { Crude.....	321,787	275,917	25,416
{ Ore.....	3,088,274	3,388,624	287,806
Manganese.....	1,566,734	1,139,463	3,980
Arsenic.....	15,771	12,121	696
Mercury.....	2	2	2
Copper vitriol.....	107,846	107,846	8,628
Iron vitriol.....	1,559,301	1,556,489	12,916
Iron ochre.....	26,930	22,534	441
Iron pyrites.....	102,500		
Cast iron.....	3,252,600	3,252,600	218,948
Steel.....	288,242	288,242	97,970
Wrought iron.....	1,457,805	1,571,724	169,083
Coal (tons of 2,240 lbs.).....	2,388,614	2,314,588	5,331,731
Jet (kin).....	14,559,481	13,997,356	5,740
Sulphur { Refined (kin).....	27,460,321	35,400,075	292,204
{ Raw material (kin).....		675,000	1,667
Graphite (kin).....	6,818,375	6,918,218	13,994
Petroleum { Refined (sho).....	7,096,600	7,780,430	52,835
{ Raw.....	644,913	42,318,680	198,142
Iron furnace bottoms (kan).....		642,093	33,635
Speiss (kin).....	15,872	8,109	794
Total.....			13,368,824

MEXICO.

By Richard E. Chism, M. E., Editor of El Minero Mexicano.

In reply to your kind letter of a late date, asking for information in regard to the mineral productions of Mexico, I will say that I have made diligent inquiries in the proper quarters, and have found that no official statistics of that nature can be obtained, except so far as respects the production of gold and silver, and even these are approximations only.

The amounts of lead, copper and iron produced here yearly are quite unknown, although the quantity of the latter two metals is insignificant and cannot at present affect in any way the markets of the world. Lead has been for some time exported from this country in the shape of ore, and it is safe to say that nine-tenths of all exportations of that kind go to the smelting works on the other side of the Rio Grande. On the other hand, a good deal of lead is beginning to be produced here by the new smelting works, but these establishments are so recent, and their workings have been so hindered from various causes that their actual capacity is so far practically unknown, and they have barely begun to affect the statistics. The production of lead and copper in Mexican old-fashioned furnaces has practically ceased, as the owners have found it more profitable to sell for export the ore that was formerly treated in that manner.

Returning to the statistics of gold and silver I note that no official figures have been published later than those for June of this year, and it is impossible to obtain any data in advance of their publication in the official newspaper. Taking, however, the figures of the last fiscal year from July 1st, 1890, to July 1st, 1891, we find them set forth as follows:

	Silver.	Gold.
Coinage.....	\$24,237,419.25	\$308,083.00
Registered for export.....	1,383,358.79	866,374.73
Total.....	\$25,620,808.04	\$1,174,457.73

There is, as most people know, a coinage tax levied upon all gold and silver produced in Mexico which must be paid whether the bullion is actually coined or not. This amounts to very nearly 5% and is evaded in some cases by smuggling the gold and silver out. What the amount of this evasion may be it is, of course, impossible to tell, but I should say that it is at least 10%. There is also a small amount of gold and silver used in the arts, but not very much, as old coins are generally preferred for such purposes, and the number of native jewellers is not so great and they work on a small scale.

There is also a large amount of silver exported in the lead ores and in purely argentiferous minerals. This is also valued in the Mexican statistics. Our table complete will then be as follows:

	Silver.	Gold.
COINED AND REGISTERED FOR EXPORT.....	\$25,620,808.04	\$1,174,457.73
Smuggled (estimated).....	2,500,000.00	125,000.00
Used in arts (estimated).....	100,000.00	20,000.00
Exported in ores, gold and silver.....	10,100,000.00	
Total production.....	\$38,320,808.04	\$1,319,457.73

The separate values of the gold and silver exported in ores are not distinguished in the Mexican statistics, so that I have placed the total amount under the head of silver, as the gold forms but a small proportional part of the value. No valuation is placed upon the lead and other metals contained in the ores, as these are not subject to export duties.

The value of the product for the calendar year of 1891 will not, I think, vary very greatly from the above. It may be stated fairly, in round numbers, as \$40,000,000, of which say 96.4% would be silver and 4.6% gold.

Chrome Steel.—Chrome steel is made in crucibles, by a re melting process, from ordinary Norway iron and a given quantity of chromium, says the *American Manufacturer*. The product, which is rolled from ingots in the ordinary commercial round, square and octagon bars, has an insertion of a layer of chrome steel hidden between an inner and outer layer of iron; the combination plates of five-ply thickness are prepared in the same manner. The completed material is said to be the hardest steel known, and easily resists the drilling, cutting or boring tool of the burglar; hence chrome steel bars and plates are extensively used in making burglar-proof safes and vaults and in the construction of jails and prisons.

RUSSIA.

We are indebted to Mr. W. A. Abeg, of St. Petersburg, Russia, for the following table:

MINERAL PRODUCTION OF RUSSIA.

	1885.	1886.	1887.	1888.	1889.
Gold.....	2,015 p.*	2,042 p.	2,128 p.	2,148 p.	2,272 p.
Platinum.....	158 "	264 "	269 "	166 "	68 "
Silver.....	687 "	811 "	938 "	924 "	846 "
Lead.....	44,000 "	48,000 "	60,000 "	49,000 "	35,314 "
Tin (Finland).....		1,000 "	1,000 "	1,200 "	721 "
Spelter.....	280,000 "	256,000 "	221,000 "	236,000 "	449,318 "
Copper.....	288,000 "	279,000 "	304,000 "	281,000 "	377,571 "
Mangan ore.....	3,696,000 "	4,542,000 "	3,554,000 "	1,996,000 "	4,713,774 "
Pig iron.....	32,266,000 "	32,484,000 "	37,389,000 "	40,715,000 "	45,535,412 "
Forged iron.....	22,116,000 "	22,182,000 "	22,550,000 "	22,256,000 "	26,307,279 "
Steel.....	11,776,806 "	14,761,500 "	13,764,500 "	13,569,000 "	16,100,059 "
Coal.....	260,578,000 "	279,394,000 "	276,779,000 "	316,592,000 "	378,899,892 "
Salt.....	69,183,000 "	73,066,000 "	70,616,000 "		
Naphtha.....	116,259,000 "	119,780,000 "	166,870,000 "	194,342,000 p.	198,970,242 "
Quicksilver ore, tons.....		9,701		28,159	42,209
Quicksilver, flasks of 24'65 kilogrammes.....			1,848	4,736	4,822
Glauber's salt.....					5,791 p.
					622,055 "

* 1 pood = 16.38 kilogrammes = 35.115 pounds.

** No separate returns of the production of salt was made for these two years. For both years the total was 84,989 846 poods.

SPAIN.*

By Roman Oriol, Mining Engineer, Editor of the Revista Minera Metalurgica y de Ingenieria.

From the remotest times of antiquity the richness, importance and variety of Spain's mineral deposits have been known, and we shall now give a succinct account of the present condition of the mining and metallurgical industry in that country.

In Spain the Government created a few years ago a Bureau of Mining Statistics and placed it in charge of the National Corps of Engineers. The service, on account of its recent and incomplete organization, has published only one volume, giving detailed statistics concerning the mining and metallurgical industry of Spain during 1887 and 1888. The report for 1889 and part of that for 1890 have been compiled, but the lamentable dilatoriness of the printing office will not enable the Bureau to publish them for some months yet, thus destroying their timeliness. For this reason we have worked in advance of the Government, and for the benefit of our readers we have compiled from the advance sheets of the reports of the executive committee of the Bureau of Mining Statistics the official figures for 1890. In regard to the figures for 1891 they are in some cases only approximately true, but they have been compiled with much care, and are not very much out of the way.

MINING.

Geographical Distribution of the Mineral Deposits of Spain.—In the North of Spain these are exploited: (1) Excellent Cretaceous iron in Vizcaya and Santander, and silicious Devonian ores in the Province of Oviedo (Asturia). (2) Blendes in the Carboniferous sandstone of Picos de Europa (Santander) and calamines in the Cretaceous system of the same Province of Santander, in Reocin and at other points. (3) Bituminous coal in Asturias, Leon and Palencia. (4) Tin in the granite of the provinces of Orense and Salamanca. (5) Quicksilver, arsenic and nickel in Asturias and cobalt in Leon.

In the middle part of Spain are worked mines of: (1) Quicksilver, in Almaden (Ciudad-Real). (2) Lead, in the provinces of Badajoz, Ciudad-Real and Toledo. (3) Silver, in the gneiss of Heindelaencina (Guadalajara) and in Prádena (Madrid). (4) Bituminous coal in Belmúz (Cordoba) and in Puertollano (Ciudad-Real). (5) Phosphorite in veins, masses and pockets in the granite and in the Devonian limestone and Cambrian slates of the province of Cáceres. (6) Glauberite in Aranjuez and Ciempozuelos (Madrid).

In the South of Spain may be mentioned extensive workings of: (1) Lead in Linares-La Carolina (Jaen); in the ranges of Cartagena and Mazarron (Murcia), in Sierra Almagrera, Sierra de Gádor and others in the Province of Almeria. (2) Copper in Rio Tinto, Tharsis, and other mines in the province of Huelva. (3) Dry, manganiferous and magnetic iron ore in various important ranges in the provinces of Almeria, Murcia, Malaga and Granada. (4) Bituminous coal in Villanueva del Rio (Sevilla). (5) Manganese in the provinces of Almeria and Huelva. (6) Sulphur in Balsas de Gador (Almeria), Lorca (Murcia) and Hellin (Albacete).

In the Levantine region are exploited: (1) Tertiary marine lignites in Alcoy (Alicante), Tertiary lacustrine lignites in Calaf (Barcelona) and in Utrillas (Teruel), and Jurassic lignites in Préjano, Turrucum and Villaroya (Logroño). (2) Bituminous coal in San Juan de las Abadesas (Gerona). (3) Rock salt in Cardona (Barcelona), and sea salt in Torrevieja (Alicante.)

The following table comprises only those provinces in which the total value of the yearly production has exceeded 1,000,000 pesetas.

RELATIVE IMPORTANCE OF THE SPANISH PROVINCES IN THEIR MINERAL PRODUCTION OF 1890

Province.	Mineral predominating.	Productive concessions.		Laborers.	Steam engines.		Value of all the minerals at mine. Pesetas *
		No.	Hectares.		No.	H.P.	
Vizcaya.....	Iron.....	152	1,934	8,384	24	571	22,200,123
Jaen.....	Lead.....	327	2,707	5,521	125	4,217	12,537,740
Murcia.....	Lead.....	494	1,899	4,094	162	2,095	12,537,215
Huelva.....	Copper.....	262	5,757	11,648	117	4,511	11,672,460
Almeria.....	Lead.....	169	711	4,164	49	1,210	9,975,434
Ciudad-Real.....	Quicksilver.....	55	197,487	3,455	48	1,377	9,779,054
Oviedo.....	Bituminous coal.....						
Cordoba.....	Iron.....	424	12,922	6,018	22	351	5,069,585
Santander.....	Bituminous coal.....	29	661	2,537	32	1,285	3,603,399
Badajoz.....	Zinc, Iron.....	63	920	2,465	33	418	2,383,096
Sevilla.....	Lead.....	19	326	1,300	18	420	2,063,056
The other 38 provinces.....	Bituminous coal.....	13	148	1,192	23	1,083	1,929,545
	Various.....	460	11,919	6,015	65	1,440	3,647,041
Total.....		2,467	237,391	56,853	718	18,978	97,422,688

* The unit of value, the peseta, which is used throughout this article is equivalent to 19.3 cents.—Ed. E. & M. J.

Fuel.—In Spain there do not exist any beds of anthracite deserving of mention, but bituminous coal is found distributed in four principal basins and various others of secondary importance. The first are: The bituminous basin of the North, which extends over the provinces of Oviedo, Leon and Palencia; the Middle basin, which occupies part of the Province of Cordoba along the Gnadato River, from Peñarroya to Bézmez and Espiel; the basin of the South which comes to the surface in the Province of Sevilla near the town of Villanueva del Rio, and disappears immediately beneath the strata of the Tertiary Miocene period; and, lastly, the basin of the Northeast, in the neighborhood of Surroca, Ogassa and San Juan de las Abadesas, also coming to the surface in Erill-Castell (Lérida). The secondary basins are: That of Puertollano (Ciudad-Real); San Adrian de los Jnarros (Burgos); Henarejos (Cuenca); Villagarcia, Fuente del Arco (Badajoz); and others of no industrial importance.

In Spain also abound the Jurassic, Cretaceous and Tertiary lignites, the most important of these on account of their extension and good quality being those of the Cretaceous period, which occupy so much territory in Utrillos, Gargallo, and Valdearriño (Teruel), in Berga (Barcelona), in Las Rozas (Santander), and other points.

Peat bogs are scarce, but there may be cited that of San Carlos de la Rápita, in the delta of the Ebro (Tarragona), with a surface of 4,000 hectares, and an occasional thickness of seven metres; that of Mandayona (Guadalajara); those of Torreblanca, Cabanes; and La Llosa de Almenar (Castellon), and others of lesser importance.

Following are the most recent figures relative to the production of coals and also a comparison of the consumption during the last thirty years.

PRODUCTION OF COAL IN SPAIN.

Provinces.	Bituminous.		Provinces.	Lignite.	
	1890. Tons.	1891. Tons.		1890. Tons.	1891. Tons.
Oviedo.....	620,704	709,000	Barcelona.....	7,505	6,089
Córdoba.....	241,778	236,000	Guipuzcoa.....	11,066	11,012
Palencia.....	97,281	120,000	Lérida.....	6,100	4,684
Sevilla.....	89,796	103,000	Baleares.....	4,070	4,528
Gerona.....	66,641	40,981	Teruel.....	964	1,111
Leon.....	20,537	22,000	Santander.....	598	693
Ciudad-Real.....	42,465	55,623	Total lignite.....	30,303	28,117
Burgos.....	577	1,650	Total bituminous..	1,179,779	1,276,000
Total bituminous..	1,179,779	1,276,000	Total production...	1,210,082	1,304,117

CONSUMPTION OF COAL IN SPAIN.

	1860. Tons.	1870. Tons.	1880. Tons.	1890. Tons.
Production of bituminous.....	320,899	621,832	825,790	1,179,779
" " lignite.....	18,952	40,095	21,338	30,303
Imports of bituminous and coke.*.....	452,479	566,911	881,860	1,840,310
Total consumption.....	792,330	1,228,838	1,728,988	3,320,392

* The coke has been given as bituminous coal, estimating the coke as 70% of the coal.

As will be seen, the consumption is far from being what it might be or what it ought to be, albeit it is increasing slowly. Nevertheless, it is a significant fact that the marked relative increase in the consumption during the last ten years proves that only with the political peace and liberty, such as has been enjoyed during that time by Spain, can her national industries flourish.

It may be well to state here that distinguished Spanish engineers have estimated the available quantity of bituminous coal at 1,800,000,000 tons, without counting the numerous beds of lignite that exist in many provinces.

The following tables shows approximately the increase in the consumption of coal by the principal Spanish industries during the past 20 years.

	1870. Tons.	1890. Tons.		1870. Tons.	1890. Tons.
Mining and Metallurgy.....	450,000	1,100,000	Merchant Navy.....	100,000	250,000
Manufactures.....	140,000	460,000	Domestic Consumption.....	50,000	250,000
Railroads.....	173,000	320,000	Other Industries.....	190,838	455,392
Illuminating Gas.....	106,000	400,000	Total.....	1,228,838	3,320,392
Electric Lighting.....	100,000	50,000			
War Navy.....	25,000	35,000			

Iron Ore.—In the year 1891 a notable decrease occurred in the exports of Somorrostro ore, as may be seen from the following official figures of the port of Bilbao: First eleven months of 1887, 3,912,729 tons; first eleven months of 1888, 3,336,652 tons; first eleven months of 1889, 3,528,896 tons; first eleven months of 1890, 3,942,648 tons; first eleven months of 1891, 3,053,910 tons. Fortunately for the country, this decrease in the shipments of ore from Bilbao is offset by the rapid growth of the metallurgical and kindred industries in Vizcaya.

In Asturias there was noticeable during 1891 a marked increase in the number of iron mines denounced, and although the Asturian ores are less pure and more refractory than those of Bilbao (they consist of Devonian, Silurian and Cambrian quartzites, impregnated with ferric oxide, and having a good deal of phosphorus), yet the future seems to hold in store the development of these workings on account of the installation of processes for working phosphoric iron ores.

The mines of Morata, in the province of Murcia, have built recently a narrow gauge railroad to a small port in the Mediterranean, whence the ore is shipped to England, the company which is working the mines being composed of Englishmen.

In the Cartagena Range, and especially in Portman, there has been a paralyzation in the shipments of those dry and manganiferous iron ores, which proved so acceptable in the United States.

In Marbella (Malaga) the magnetic ores, of which great quantities have been exported to the United States, continue to be exploited actively. We think that in 1891, 180,000 tons have been taken out. It appears that other deposits of magnetic ores exist further inland in the Province of Malaga, and the working of them will depend upon the possibility of taking the ores to the shipping port at a sufficiently low price. The important mines of manganiferous iron of Las Herreras in the Province of Al-

meria which have been flooded for several years are on the eve of being worked anew and on a large scale. Mr. H. Borner is now finishing the unwatering of the Santa Matilde clearing and is constructing a dam to prevent the overflowing of the Almanzora River and its interference with the work of mining. There have been placed in position five Allen's pumps, each with its engine of 115 H. P.; but two are sufficient for the work, the capacity of each being 300 litres per second. The wall which will protect the works against future floods is 115 m. long, 8 m. high, and 4 m. thick at the base. The deposit of Las Herreras is ascertained to be more than a kilometer in length with a thickness of about 40 m., and a dip of 45° S. and 60° E. In that part of it which has been unwatered there have been found Phœnician and Roman coins, and also some ancient weapons imbedded in the compact rock. The deposit is very odd and was formerly exploited only for silver, but in the future it can be worked for its manganiferous as well as it for its argenteiferous irons.

Quicksilver.—The product of the mines of Almaden in 1891 has been as follows, the figures being given in flasks: January, 8,011; February, 7,560; March, 6,697; April, 7,069; October, 3,676; November, 7,042; December (estimated), 7,500; total, 47,555 flasks, or 2,480 flasks less than in 1890, and 1,922 less than in 1889.

During the year 1891, there have been extracted 7,100 cubic meters of ore and 320 cubic meters of waste; there have been constructed 671 cubic meters of stone and mortar work in arches and 4,870 cubic meters of solid work, making a total of 5,541 cubic meters of stone work (in all these figures the work for December has been estimated conservatively).

The decrease in the output this year is not due to an impoverishment of the ore, but to the necessity of employing a great deal of the money which might have been used to extract more ore to the opening of another level. The Government of Spain has not given the funds asked for again and again by the engineers for the timely preparation of the levels. Due to engineers' foresight, the main shaft of San Teodoro is to-day 21 m. below the 11th level; and during this month (December) it will be to the bottom. The 12th level, which will be begun in 1892, will be 343-13 m. in depth, or 30 m. below the 11th level.

Beside Almaden all the other quicksilver producing mines lose their importance, but we do not wish to leave unmentioned the Sociedad "El Porvenir," a company which is working successfully some banks of Carboniferous sandstone impregnated with cinnabar found near the town of Mieres (Asturias). The mineral carries on an average less than 1% of quicksilver. These banks are continuous, and there are indications that the cinnabar is to be found beyond the property of "El Porvenir." We understand that a company has entered into negotiations with a well known English firm for the exploration of these sandstone banks. If the results prove as favorable as now seems probable from a superficial examination of the new mines, a company will be formed, which contribute to the increase of the production of quicksilver in the Asturian region.

Lead.—New deposits of lead ore are being discovered daily, a fact which will help Spain to maintain her rank among the lead producing nations. During 1891 numerous companies have been organized, such as the "Compañia Francesa de Minas de Río Corrunder," which will work the argenteiferous galena of Villalba del Alcor and Manzanilla (Province of Huelva). A company was formed in Paris to work the argenteiferous ore of the El Galayo mine, near Puebla de los Infantes (Sevilla), and others. The district of Zalamea de la Serena (Badajoz) has been explored on a limited scale. These mines require a large capital to work them on account of the quantities of water which filter through the altered granite within which are the veins. It is sought to recommence the working of the argenteiferous veins of Plasenzuela (Caceres). The important lead districts of Linares-La Carolina, in the Province of Jaen, and of Cartagena and Mazarron, in Murcia, have continued their work.

The most important problem in Spanish lead mining, which should be solved in 1892, is the unwatering of the rich mines of Sierra Almagrera, in the Province of Almeria. According to the report prepared, by order of the Government, by a corps of engineers under Inspector General Dor Pablo Garcia Martino, the problem is reduced to the raising a maximum of 7,000 tons of water every 24 hours to a height of 163 m. This does not offer any technical difficulties. Economically it would offer none, provided there existed some union among the numerous mine owners. It is estimated that the cost of placing a plant there would be 1,500,000 *pesetas*, and the annual expenses, including interest on this, would be only 600,000 *pesetas*. At present the syndicate appointed by the miners in accordance with the law of August 1st, 1889, is preparing a list of conditions to let the contract for the unwatering of these mines to the lowest bidder. The general opinion, however, is that there will be no bidders, and it will be necessary to call upon the large contracting houses and urge them to say what condition they will accept. The future of more than 40 veins of argenteiferous lead depends upon the realization of this project of unwatering the mines conjointly, for since the water filters from one mine into another, there can be no unwatering of a single mine among those of the *barracos* Jaroso, Francés and Chaparral which furrow the famous Sierra Almagrera. The subdivision of mining property, the outcome of the liberality of the Spanish Government, will be always an obstacle which will hinder actions that demand the union of those interested, as in the present case of unwatering these mines.

The district of Linares-La Carolina, in the province of Jaen, is undoubtedly foremost in Spain. Following are the principal figures: Total number of mines, 1,500; surface in hectares, 13,000; number of lineal metres of main shafts, 63,000; number of lineal metres of interior shafts, 87,000; kilometres of open galleries, 780; number of steam engines, 210; total horse power, 6,600; number of windlasses, 600; number of horses working daily, 1,300; number of laborers, 7,100; average production of lead ores in metric tons, 115,000.

PRODUCTION OF LEAD ORE IN THE DISTRICT OF LINARES-FA CAROLINA.

Year.	Tons.	Year.	Tons.	Year.	Tons.	Year.	Tons.
1881	118,325	1884	117,485	1886	115,730	1889	112,500
1882	110,720	1885	101,555	1887	119,997	1890	117,240
1883	117,738	.....	.....	1888	114,300	1891	115,000

* Estimated.

Copper.—The exploitation of ferro-cuprous pyrites remains confined to the Province of Huelva, where such well known mines as the Rio Tinto, Tharsis, Builtron and others, are found. The Portuguese company which is the mines of Sotiel-Coronada is prosecuting operations with great activity.

The following figures show the growth attained by the Rio Tinto mines:

PRODUCTION OF COPPER BY THE RIO TINTO COMPANY (LIMITED).

	Pyrites extracted.			Average copper contents.	Pyrites consumed.			Copper produced at mines.
	For shipment.	For local treatment.	Total.		Tons.	Average copper contents.	Tons.	
1876...	189,962	159,196	349,158	1.5%	158,597	1.5%	946	
1877...	251,360	529,391	771,751	2.375	211,187	2	2,195	
1878...	218,818	652,289	871,107	2.78	211,403	2.18	4,184	
1879...	43,241	663,359	906,600	2.78	236,819	2.45	7,179	
1880...	277,590	637,567	915,157	2.865	274,210	2.481	8,559	
1881...	249,098	743,919	993,017	2.75	256,827	2.317	9,466	
1882...	259,921	658,307	918,228	2.805	272,825	2.101	9,740	
1883...	313,291	786,682	1,099,973	2.95	288,104	2.387	12,235	
1884...	312,028	1,057,890	1,369,918	3.251	314,751	2.241	12,968	
1885...	406,772	941,694	1,348,466	3.102	354,501	2.271	14,593	
1886...	331,543	1,011,833	1,343,376	3.043	347,021	2.306	15,863	
1887...	362,796	819,641	1,182,437	3.017	385,841	2.283	17,813	
1888...	434,316	969,317	1,403,633	2.949	393,119	2.208	18,522	
1889...	389,913	824,350	1,214,263	2.854	395,081	2.595	18,708	
1890...	396,319	865,405	1,261,724	2.883	397,575	2.595	19,183	

The mines of Carracedo, in the province of Palencia, which have, in a granitiferous diorite, various veins of ore with an average of 10% copper, continue inactive despite of their excellent conditions for working.

In the Province of Badajoz, in an extensive zone which extends from Llerena to Azuaga there are being explored various mines which show copper mineral. In Llerena copper was found while looking for quicksilver, some cinnabar having been met with in the surface. In Azuaga there are also some deposits of lead.

Tin.—Various Spanish and foreign companies are working in a small scale the alluvial deposits and also the veins in granite found in El Viso and other parts of the Province of Orense. To-day great activity is noticeable in that and adjoining provinces. Demands for grants from the Government according to law are very numerous. The principal companies working the tin mines of Orense are the "San Francisco" of Avion, the "New Viso Company, Limited," and a Dutch company, "Galicia Tin Maatschappij," whose properties are in Pentes, near La Gudina.

The companies which have undertaken the workings of the Salamanca tin mines are also foreign, to wit, the "Salamanca Tin Company, Limited," of England, and a German company known as the "Deutsche Gesellschaft für Bergbau in Spanien." The veins of Salamanca are veins of quartz irregularly mineralized with tin, accompanied by wolfram. They are difficult and costly to prospect on account of their irregular character. The alluvial deposits are rich in tin, and are worked with profit.

MINERAL PRODUCTION OF SPAIN IN 1890.

Substance.	Productive concessions.		Laborers.	Steam Engines.		Production.	
	No.	Hect. res.		No.	H. P.	Tons.	Value at mines.
Iron	292	4,638	12,076	47	861	5,788,748	28,271,021
Lead	421	3,896	9,265	176	5,215	163,838	20,643,479
Lead argentiferous	623	2,733	8,212	237	4,742	300,371	16,786,836
Silver	12	24	283	2	48	13,815	143,707
Copper	263	5,793	11,923	117	4,560	2,285,625	11,809,400
Copper argentiferous	11	198	111	4	64	5,463	377,300
Tin	15	532	272	2	110	48	43,099
Zinc	74	704	1,625	24	275	59,782	1,931,158
Quicksilver	18	196,137	1,423	8	190	34,028	6,077,858
Antimony	11	170	225	2	22	679	101,883
Cobalt	3	21	48	2	22	74	11,025
Manganese	10	79	134	2	22	832	13,115
Salt	83	1,229	459	3	16	320,336	4,343,169
Sodium sulphate	2	10	13	3	16	329	1,645
Barytes	2	()	2	3	16	130	5,200
Sulphur	5	37	360	1	10	30,050	384,650
Phosphoric acid	13	87	162	12	379	889	5,567
Steatite	6	49	52	12	379	3,155	43,610
Kaolin	7	64	78	1	20	1,558	79,838
Soft coal	529	18,834	9,314	79	2,433	1,179,779	9,621,945
Lignite	36	1,410	584	1	8	30,303	183,157
Jet	5	112	25	1	8	55	26,325
Graphite	1	112	4	1	8	100	5,600
Total	2,446	237,062	56,623	716	18,903	10,223,850	101,440,707

METALLURGY.

It is to be regretted that the metallurgical industry of Spain has not become as important as the abundance and richness of her mineral deposits and the growth of the mining industry warrant.

RELATIVE IMPORTANCE OF THE SPANISH PROVINCES IN THE METALLURGICAL PRODUCTION FOR 1890.

Province.	Metal predominating.	Works in operation.	Hydraulic.		Machines. Steam.		Laborers.	Production of Metals.	
			No.	H. P.	No.	H. P.		Tons.	Pesetas.
Murcia	Lead	17	...	...	15	172	857	116,911	17,020,980
Vizcaya	Iron	6	9	258	120	19,461	3,809	212,922	25,217,548
Huelva	Copper	14	3	82	70	1,542	3,603	36,690	22,243,165
Oviedo	Fe and Zn	9	8	330	125	3,461	3,927	81,967	15,383,026
Almeria	Lead	17	...	...	133	13	420	28,712	10,141,200
Ciudad Real	Quicksilver	1	...	...	1	15	518	1,735	9,830,725
Cordoba	Lead	20	...	...	9	128	394	57,845	9,604,680
Guipuzcoa	Pb & Fe	8	9	285	25	677	575	41,636	4,588,233
Malaga	Fe & Pb	2	...	...	11	461	388	4,537	1,999,240
Santander	Zinc	5	...	...	32	3	28	21,492	1,158,897
Other 14 Provinces	Various	60	37	727	37	838	1,869	268,576	15,177,240
Total		159	68	1,717	428	26,961	16,504	876,021	16,361,994

The iron production of Spain is derived chiefly from the provinces of Vizcaya and Asturias. In the first mentioned the most important companies are "Sociedad de Altos Hornos de Bilbao," "La Vizcaya," and the "San Francisco." The "Sociedad de Altos Hornos de Bilbao" has Bessemer and Siemens-Martin plants and manufactures steel rails for Spanish consumption and all classes of iron and steel for use in the construction of mining and metallurgical plants. It is without doubt the most important of the Spanish iron works. "La Vizcaya" company is growing daily and intends to blow in a double regenerative Siemens furnace. To-day this is the company which manufactures the greatest quantity of Siemens-Martin steel and ingot, which it exports principally to Italy, although in 1891 it shipped a great portion of its product to Glasgow.

Beside these may be mentioned other iron works smaller but of great usefulness. The "Iberia" company has built near La Vizcaya shops for the manufacture of tin plate. These have grown to such an extent that they supply the national consumption, as may be seen by the figures of importations. The "Talleres de Deusto" manufactures steel by the Roberts process and makes all classes of tools. These came into the market in 1891 and have become very popular on account of their quality and excellent finish.

The "Santa Agueda" works, in Castrejana, belonging to Messrs. Eugenio de Aguirre & Co., have in operation two double regenerative Siemens furnaces for puddling. Their great success has caused other manufacturers to ask for prices from the Siemens company. It is rumored that a company will be formed in Bilbao with a capital of 12,000,000 pesetas. Its object is not known, a great deal of secrecy being observed in all its movements. It is to be hoped, however, that it will devote itself to the construction of locomotives and motive power engines in general.

In Asturias are to be found various iron works, chief among which is the "Fabrica de Mieres." This company owns also the blast furnaces of Quiros and large mines of bituminous coal and of iron in the same province. This establishment is as well appointed as the best of Bilbao, except in the manufacture of steel. Since it abandoned its manufacture by the cementation process which it employed at La Barzana, near Pola de Lena, it has not found it necessary to erect new steel works. Its bridge building shops are very good.

The national artillery factory at Trubia blew in a 10-ton Siemens furnace in 1891, which has worked successfully from its inception. Among other great construction shops may be mentioned those of the Maquinista Terrestre y Maritima Company, of Barcelona, which shops have contracted to build the motors necessary for the different ships of the navy.

The metallurgy of lead in Spain has developed nothing new during 1891. A new plant was built at Linares by Messrs. Figueroa & Co., the lessees of the Arrayanes mine which belongs to the Government; but it cannot be said that it will influence the production. Since the Arrayanes ores which will be worked by the new company were sent formerly to the La Cruz Company, the latter will thus lose precisely what will be gained by Messrs. Figueroa & Co. In Mazarron the magnificent plant of "Santa Elisa" continues to grow rapidly, due to the rich ores extracted from San Cristobal Mountain by the different mining companies.

The only novelty in the metallurgy of copper in Spain during 1891 was the commencement and subsequent excellent work of the Manbés system in Jerez-Lanteira (Granada). The description and drawings of the new converter published by the *Revista Minera, Metalurgica y de Ingenieria*, of Madrid [reproduced in the ENGINEERING AND MINING JOURNAL of Sept. 12, 1891], enables us to dispense with the description of this plant. The copper obtained has been exceptionally pure. It has been assayed at the School of Mines and has shown a fineness of 99.50% to 99.75% of metallic copper.

In the Cerco de Buitrones of Almaden nothing new has happened during 1891. Some new processes are being studied by a commission of Government Engineers.

IMPORTS INTO SPAIN.

Article.	1889.		1890.		1891.	
	Tons.	Pesetas.	Tons.	Pesetas.	Tons.	Pesetas.
Bituminous coal	1,335,809	33,395,222	1,431,623	37,222,205	1,675,500	43,550,000
Coke	279,144	6,978,561	286,081	7,438,091	250,000	6,500,000
Sulphur	7,479	972,232	12,059	1,567,638	8,500	1,105,000
Iron, cast	27,937	1,955,511	34,335	2,403,417	30,000	2,100,000
Iron, molded	12,685	2,912,755	16,580	3,611,083	18,000	3,900,000
Iron, forged	49,850	9,373,845	61,717	12,645,415	49,000	9,000,000
Pig tin	494	1,255,551	582	1,456,087	600	1,563,600
Tin plate	4,638	2,564,367	3,070	1,777,010	2,400	1,250,000
Motive machines	6,710	8,051,900	9,418	11,901,514	9,200	11,000,000
Total	1,724,746	67,140,012	1,855,465	79,422,460	2,042,700	79,968,000

EXPORTS FROM SPAIN.

Article.	1889.		1890.		1891.	
	Tons.	Pesetas.	Tons.	Pesetas.	Tons.	Pesetas.
Iron	5,051,613	55,567,748	5,708,811	62,796,919	4,500,000	49,500,000
Copper	781,025	30,034,461	704,582	27,269,754	750,000	28,500,000
Zinc	36,108	1,062,626	47,025	1,379,205	42,000	1,176,000
Lead	12,646	5,968,079	12,954	4,068,827	8,200	3,000,000
Manganese	3,137	408,374	5,570	261,801	1,900	47,000
Antimony	254	76,323	597	179,066	500	150,000
Common salt	323,602	4,854,026	258,030	3,870,151	219,000	3,285,000
Soft coal	16,633	415,827	16,796	436,300	10,800	300,000
Iron pyrites	121,928	1,219,281	163,825	1,638,255	248,000	2,480,000
Phosphoric acid	8,520	85,200	20	200	1,600	160,000
Total	6,360,516	99,662,945	6,918,330	102,790,178	5,781,100	88,561,000
Minerals.						
Cast iron	65,471	5,237,656	67,446	5,395,710	68,000	5,700,000
Copper	37,369	31,685,373	33,058	29,388,043	33,000	25,000,000
Zinc	2,494	1,371,331	2,010	1,045,368	2,150	1,135,000
Lead	136,956	58,073,134	140,325	66,208,155	140,000	65,800,000
Quicksilver	1,974	11,057,268	989	5,736,821	2,000	11,600,000
Total	244,264	107,425,367	219,828	107,754,097	245,180	109,236,000
minerals	6,360,516	99,662,945	6,918,330	102,790,178	5,781,100	88,561,000
exports	6,604,780	207,088,312	7,168,048	210,544,275	6,026,280	197,827,000

METALLURGICAL PRODUCTION OF SPAIN IN 1890.

Substance.	Works in operation.	Hydraulic Machines.		Steam.		Laborers.	Production.	
		No. Power.	No. Power.	Tons.	Pesetas.			
Iron	22	39	1,266	256	23,624	7,985	179,433 Fe. cast 63,933 Fe. wr't 63,011 steel 98,843 Pb	12,065,500 14,936,504 12,614,730 30,176,791
Lead	13	..	..	21	210	1,146	92,354 Pb & Ag	40,69,066
Argentiferous	25	..	16	26	295	1,180	46	7,673,049
Silver	2	..	82	1	5	15	36,090	22,243,165
Copper	14	3	..	70	1,542	3,693	5,807 Zn 21,021 ZnO,CO ₂	4,179,318 1,097,648
Zinc	5	..	..	15	150	644	1,819	10,364,946
Quicksilver	4	..	..	2	40	..	53.4 Orpim.	21,580
Arsenic	1	..	..	1	..	628	16.1 As	?

The total imports and exports of Spain in 1890 and 1891 were as follows:

	Imports: Pesetas.	Exports: Pesetas.
1890	866,311,424	893,855,826
1891	911,137,925	937,759,883

*Of 1891 we know only that the imports for the first 10 months were 10,000,000 pesetas less than for the corresponding period of 1890, and that the exports for the same time exceeded by 20,000,000 those for 1890.

By comparing these figures with the figures relating to the mining and metallurgical industries it will be seen that the mineral products form 8% of the imports and 23% of the exports of Spain. Such industries as this, which form a fourth of the total exports, are of an importance which it would be impossible not to recognize.

UNITED KINGDOM OF GREAT BRITAIN AND IRELAND.

MINERAL PRODUCE OF THE UNITED KINGDOM IN 1889 AND 1890.

Description of mineral.	1889.		1890.	
	Quantity.	Value at mines.	Quantity.	Value at mines.
Alum clay (bauxite).....Tons	9,150	£5,490	11,527	£5,763
Alum shale....."	4,188	522	6,420	802
Antimony ore....."	67	900	14	200
Arsenic....."	4,758	38,260	7,276	60,727
Arsenical pyrites....."	7,688	7,317	5,114	4,414
Barytes....."	24,849	28,238	25,353	29,684
Bog ore....."	14,002	7,001	14,512	7,256
Clays (excepting ordinary clay)....."	3,036,253	828,174	3,308,214	899,166
Coal....."	176,916,724	56,175,426	181,614,288	74,953,997
Cobalt and nickel ore....."	155	938	81	380
Copper ore....."	9,029	26,581	12,136	27,801
Copper precipitate....."	281	3,113	345	4,670
Fluorspar....."	297	411	268	392
Gold ore....."	6,226	10,746	675	434
Gypsum....."	132,357	53,819	140,293	57,991
Iron ore....."	14,546,105	3,848,268	13,780,767	3,926,445
Iron pyrites....."	17,719	8,111	16,018	7,666
Jets.....Lbs.	618	124	1,228	215
Lead ore.....Tons	48,465	429,647	45,651	406,164
Lignite....."	947	284	2,630	767
Manganese ore....."	8,852	6,478	12,444	6,733
Ochre, amber, etc....."	10,494	15,532	19,068	17,475
Oil shale....."	2,014,860	503,715	2,242,250	608,369
Petroleum....."	30	45	35	52
Phosphate of lime....."	20,000	38,250	18,000	29,500
Salt....."	1,946,496	890,364	2,146,849	1,170,014
Slates and slabs....."	458,436	1,048,143	434,352	1,027,235
Stone, etc....."	..	8,670,335	..	8,708,691
Sulphate of strontia....."	5,976	2,988	10,274	5,138
Tin ore....."	13,809	729,215	14,911	782,492
Uranium ore....."	..	..	22	2,200
Wolfram....."	..	8	104	1,848
Zinc ore....."	23,202	96,925	22,041	109,890
Total values.....	..	£73,476,000	..	£92,791,481

PRODUCTION OF METALS IN THE UNITED KINGDOM IN 1889 AND 1890.

Description of metal.	1889.		1890.	
	Quantity.	Value.	Quantity.	Value.
Aluminium.....Lbs.	12,000	£26,000	..	..
Sodium....."	63,726	9,145	..	..
Antimony.....Cwts.	666	1,998	154	£565
Copper.....Tons	905	49,548	976	57,057
Gold.....Lbs	3,891	14,227	206	675
Iron.....Tons	5,181,773	12,695,246	4,848,718	14,878,884
Lead.....Tons	35,604	461,342	33,597	449,826
Silver.....Ozs.	306,149	54,453	291,724	58,010
Tin.....Tons	8,912	890,342	9,602	937,760
Zinc.....Tons	9,392	192,145	8,582	203,358
Total values.....	..	£14,346,846	..	£16,516,758

The total production of pig iron in the United Kingdom in 1890, including that made from foreign ore, was 7,904,214 tons, as compared with 8,322,821 tons in 1889. In making it 19,213,916 tons of ore and 13,763,694 tons of coal were used, and its total value, calculated at the average price for the year, was £21,140,786, of which, as shown above, £14,808,884 was the value of that obtained from British ore.

BALTIMORE MINING STOCK MARKET IN 1891.

From our Special Correspondent.

The market for mining stocks in Baltimore during the year 1891 has been listless and dull, and has offered no encouragement to brokers or operators to indulge in new ventures. No new companies have been floated nor have any applications been received for listing new securities on the Exchange, with the exception of the Howard Coal and Coke Company, the successor to the Monongahela Gas Coal Company, which asks for a quotation for its shares. The fancy shares have been very passive, no movement worthy of note having occurred in them. An assessment of five cents per share was levied on Baltimore & North Carolina, and quite

a block of the stock on which it was not paid was forfeited to the company. The coal stocks about held their own and paid their usual dividends.

FLUCTUATIONS IN PRICES OF MINING STOCKS AT BALTIMORE DURING 1891.

NAME OF COMP'Y.	Par value	Opening.		Highest and lowest during the year.				Closing.	
		Bid.	Asked.	Bid.		Asked.		Bid.	Asked.
				H.	L.	H.	L.		
Atlantic Coal.....	\$10	\$.90	\$1.50	\$1.15	.85	\$1.50	\$1.00	..	..
Balt. & N'ch Caro.	5	.05	.10	.10	.01	..	..	..	..
Big Vein Coal.....	10	.07	1.25	..	..	1.45	1.00	..	1.25
Conrad Hill.....	5	..	1.10	..	..	.10	.07	..	.10
Consol. Coal.....	100	.24 3/4	.26 3/4	.28	.23 1/2	.30	.24	.28	.29
Diamond Tunnel.	10	.20	.35	.20	..	.35	..	..	..
George's Creek...	160	1.10	1.15	1.14	1.00	1.15	1.10	1.05	1.10
Lake Chrome.....	5	.20	.30	.30	.10	.40	.15	..	.15
Md. & Charlotte..	5	..	..	..	..	..	..	..	..
N. State, Balto...	5	.10	..	.10	..	..	..	..	..
Ore Knob.....	10	..	..	..	..	..	..	..	..
Silver Valley....	5	.60	.90	.75	.50	.90	.55	.54	.65

THE BOSTON MINING STOCK MARKET IN 1891.

From our Special Correspondent.

The past year has not proved a very satisfactory one to holders of mining stocks. The constantly declining tendency of ingot copper and the consequent reduction of profits and dividends has resulted in a heavy decline in the price of copper stocks, and although there have been times when the market gave promise of greater activity and better prices, there was no permanent advance and nothing like the activity which was witnessed in the early part of 1890, while the closing of the year points to no improvement as likely to occur for the present.

The copper stocks may be said to be a Boston specialty, as in no city in the East has so much capital been invested in this class of securities as in Boston. For many years the Lake Superior copper mines have been largely owned and developed by capitalists of this city, and large fortunes have been made by speculation in them, and to-day the richest mine in the country is owned and controlled by Boston people, and pays annually into the pockets of its stockholders a goodly revenue from its operations. While its stock is eagerly sought for at a large advance over its par value for permanent investment. In 1865 the Calumet mine, then in its infancy, was selling at \$1 per share, and it was several years before it gave promise of being of much value, when by accident the vein which has proved such a bonanza was discovered, and in spite of an assessment of \$5 per share the stock advanced to \$30. Subsequently a new company, the Hecla, was organized and apportioned to the holders of the Calumet, and in 1871 the two companies were consolidated under the present name, since which it has maintained its reputation as the king of producers, and has paid its stockholders \$36,850,000 in dividends. During the past year the mine has produced 44,915 tons of ingot copper and paid \$20 per share in dividends. The highest price for the stock during the year was \$280, March 31st, and the lowest \$240, the average being about \$260.

One of the most formidable competitors of the Calumet & Hecla is the Tamarack, which is steadily growing in favor as an investment, and sells readily whenever its stock is offered on the market. Its product for the year is about 10,000 tons and it has paid \$16 in dividends. The stock has sold as high as \$179 the past year, the lowest point touched being \$140, making an average of about \$150.

Dealings in Tamarack Jr., have been confined to the Street, the stock not being listed on the Exchange. The mine is being developed and although the expectations of a year ago have not been fully realized, it still gives promise of being eventually a good producer. The stock has sold as high as \$60 per share during the year, and possibly higher, but as there are no published records of sales we are unable to give the exact figures.

The contest for the Pewabic mine resulted in the Quincy getting possession of the property and it is now being worked as a part of the Quincy mine. The price paid for it is thought to have been in excess of its real value and there is likely to be some litigation as to the legality of the purchase. The property was bid off to parties in the interest of the Quincy at about \$700,000 and turned over to the company for 10,000 shares of its stock worth over \$1,000,000. There has been a good deal of adverse criticism at the action of the directors in relation to the matter on the part of the stockholders. A few months ago the company refused to transfer stock belonging to a prominent director, and dealings in the stock on the Exchange was prohibited in consequence, and up to this date the stock has not been restored to the list. The highest price for the stock up to the time dealings were suspended was \$112 and the lowest \$85. Sales at the brokers' offices and on the Street have ranged from \$100 to \$110. The company continues to improve its output and has paid \$10 per share in dividends during the past year.

The Franklin paid its stockholders a dividend of \$2 per share in July last, after the Pewabic matter was settled and has quite a large reserve fund on hand; development work has been pushed, but the production for the year has not been quite up to the average. The stock has ruled quiet throughout the year, the highest point touched being \$19 and the lowest \$14.

Oseola at the opening of the year was selling at about \$35, and reached its highest point, \$41 1/2, on September 9th, since which it has followed the course of the market and dropped to \$26 on the first of the present month, with a slight advance later on. The mine has proved to be a good producer, increasing its output the past year about 600 tons and has paid three dividends of \$1 each. At the present low price of ingot copper it is doubtful if the same ratio of dividends can be maintained.

Atlantic has shared in the general depression of the market. The highest point touched this year was \$18, the lowest \$10. Owing to the high cost of production and the low price obtained for its output only one dividend of \$1 per share has been paid this year.

The two mines from which much has been anticipated as producers and dividend payers, viz., Centennial and Kearsage, have not come up to

expectations of their friends. While the outlook for them is good, they have not been so far developed as to prove remunerative. The stock of the Centennial, which was pushed up to \$47 1/2 per share in 1890 sold down to \$11 1/2 the present year, the highest point reached being \$22. The Kearsage sold during the year at \$17 and as low as \$10 per share.

Allouez has not made much of a showing during the past year. Two assessments of 50c. each have been paid in, but the expense of getting out copper has been so large owing to causes beyond the control of the company that the product has not been sufficient to meet the outlay and further assessments will be necessary to keep the company out of debt. The mine has been obliged to shut down several times during the year for want of water. The highest price the stock reached during the year was \$44, and the lowest \$14.

The Huron Mining Company, which assessed its stockholders last year \$5 per share to pay off its debt and put the mine in good working order,

has met with disaster, and has again called upon its shareholders for a further assessment of \$3 which practically wipes the stock out. The expense of producing copper at 18c. per lb. while the market value was only about 11 1/2c. cannot be said to be very encouraging, and it is doubtful if any more money will be put into the enterprise by the present owners. The latest report is that the miners have been paid off and the mine shut down. The stock sold early in the year at \$3 1/2—the latest sales reported were at 10c., assessment unpaid.

The National mine has not shown any great degree of activity. Its stock sold up to \$ 1/2 and down to \$1 1/2. The outlook of the mine is said to be favorable, and any improvement in the price of ingot copper would help the market for the stock.

The outlook for Arno d has improved, and its friends claim that it will soon be a good producer. The stock sold as low as 30 cents and up to \$2 1/2.

FLUCTUATIONS OF PRICES OF MINING STOCKS IN BOSTON DURING 1891.

Table with columns for NAME & LOCATION OF COMPANY, Par val., and months from January to December, plus Sales. Lists various mining companies like Allouez, Arnold, Atlantic, etc.

* Formerly Security Mining and Milling Company.

FLUCTUATIONS IN PRICES OF MINING STOCKS IN DENVER DURING 1891.

Table with columns for NAME AND LOCATION OF COMPANY, and months from January to December, plus Sales. Lists various mining companies like Allegheny, Amity, B'rat Smur'r, etc.

Recumseh sold at one time up to \$3½. There have been no sales of it of late. The work of developing the mine was pushed with considerable vigor during the summer months with very good results, but owing to the condition of the copper market we hear that it has been decided to suspend further operations for the present.

The stock of a new company, the Wolverine, was listed on the Exchange in September, selling at \$6½, from which price it advanced to \$7, but later sales are quoted at \$4. The property is located in Houghton County, Mich., and is said to have good prospects.

There has been very little doing during the past year in the "little coppers" as they are familiarly known on the Street. We note sales of Ridge at 50@75c.; Humbolt, 20@50c.; Hungarian, 25c.; Dana, 25c.; Mesnard, 35c.; Poatiac, 25c.; Washington, 20c.; South Side, 15c.; Native, 14c.; Star, 8@20c.; Winthrop, 15c.

The Montana group of copper and silver stocks have been very active during the year. The Boston & Montana is largely held for investment by Boston people, and has produced an average monthly product of fine copper of 2,000,000 lbs. and about 285,000 oz. of silver for the year. It has paid \$4 in dividends during the year, and the stock has sold up to \$50 and down to \$36½, the latter during the present month.

The Butte & Boston, also owned and controlled by Boston parties, is proving all its friends have claimed for it. Its output is nearly equal to its neighbor and it is said it can produce copper at a less price than the Boston & Montana. It has 200,000 shares of par value of \$25, being 75,000 shares more than the Boston & Montana, and its stock has sold as high as \$20 per share and down to \$13. The company has as yet paid no dividends, its policy being to apply its net earnings toward paying its bonded indebtedness, which is about \$1,050,000.

Santa Fé, from which much has been expected, has not yet prove remunerative. Its stock has sold from 30c. to 65c. during the year and is now its lowest price.

Bonanza Development sold up to 67½c. at one time during the past year, the lowest point being 40c. the latest quotation.

The silver stocks have not made much of a show in the dealings on the market, and prices have gradually declined to nominal figures. Dunkin Silver Mining Company, one of Boston's favorites, has hardly been heard from. There were some sales at 67½c. early in the year, but later quotations are nominal and in the neighborhood of 40c. It is reported that the company has not made any money the past twelve months.

Breece, like Dunkin a Leadville mine, has ruled quiet with now and then a sale ranging from 30c. to 50c. Catalpa and Crescent, both owned largely in this city, have also done nothing by way of improvement, and sales have been made at 20c. for the former and 10c. for the latter. There has been some trading in Napa quicksilver at prices ranging from \$3½ to \$5½, the present price being \$4½. The company has paid regular quarterly dividends of 10c. and is said to be doing well.

The Coeur d'Alene a silver mine located in Idaho, was placed upon the market in July last at \$1½ per share, but dealings in it have been very limited and of late it has dropped out of sight altogether. It pays regular monthly dividends of 2c. per share and is said to be a good investment.

NEW YORK MINING STOCK MARKET IN 1891.

It is now almost two years since the ENGINEERING AND MINING JOURNAL commenced its vigorous crusade against the infamous "mill ring," which has defrauded thousands of Comstock shareholders, and which has rendered the term "mining on the Comstock Lode" synonymous with "wholesale robbery." Though this lamentable state of affairs had been an open secret for some years, yet we were the first to make public all the facts and figures, exposing in detail the fraud, and showing the ingenious *modus operandi* of the men who have brought discredit to the Pacific Slope. During the year we have devoted considerable space to affairs at the great lode and closed the year by giving a photographic illustration of how some of this swindling is carried on. We have been the recipients of letters from mining men all over the country commending our course and we feel justifiable satisfaction in knowing that the ENGINEERING AND MINING JOURNAL, now as always, has fought the men who fain would cast odium on mining by their swindling schemes.

The course of the various Comstock shares in this market has not been characterized by any features of intrinsic interest. A glance at the comprehensive table of prices of mining stocks in the New York market during 1891 will show that the prices of the various Comstock shares apparently underwent a marked advance in April and May. This advance was, however, due solely to manipulation on the part of the "ring." There have been at various times rumors about strikes and favorable developments, none of which has passed beyond rumorhood. Of the sales reported to have been made at the Consolidated Stock and Petroleum Exchange, we venture to say that more than one-half were not legitimate. The brokers defend the practice of matched sales by saying that they are necessary in order to simulate an activity which long ago departed from the Exchange. The fallacy of this argument is so obvious that it is unnecessary to refute it in print.

Following are the opening, highest and closing prices of the various Comstock companies during the year: Alpha, \$1.10, \$1.45, 80c.; Alta, 65c., \$1.50, 65c.; Andes, 80c., \$2.60, \$1.10; Argenta, 15c., 15c., 10c.; Barcelona, 9c., 20c., 6c.; Belcher, \$1.50, \$3.40, \$1.65; Best & Pelcher, \$2.15, \$8.25, \$2.00; Bullion, \$2.50, \$3.70, \$1.20; Collar, \$2, \$3.85, \$1.30; Comstock Tunnel stock, 14c., 40c., 15c.; Comstock Tunnel bonds, 30c., 41c., 28c.; Comstock Tunnel scrip, 35c., 45c., 36c.; Consolidated California and Virginia, \$1.90, \$14.75, \$3.80; Consolidated Imperial, 25c., 33c., 20c.; Crown Point, \$1.95, \$3.10, 85c.; Exchequer, 80c., \$1.30, 65c.; Gould & Curry, \$2.65, \$3.90, \$1.15; Julia Consolidated, 20c., 30c., 18c.; Justice, \$1.20; Kossuth, 12c.; Mexican, \$2.80, \$5.12, \$1.70; Occidental, 90c., \$1.40, 60c.; Ophir, \$3.85, \$9.25, \$2.75; Overman, \$1.90, \$3.20, \$1.60; Potosi, \$5.38, \$7, \$1.45; Savage, \$2.75, \$4.15, \$1.30; Scorpion, 35c., 55c., 30c.; Sierra Nevada, \$1.40, \$2, 80c.; Sierra Nevada, \$2.20, \$4.35, 25c.; Silver Hill, 35c., 55c., 30c.; Sutter Tunnel, 10c., 5c.; Union Consolidated, \$2.35; \$4.25, \$1.15; Utah, 90c., \$1.45, 55c.; Yellow Jacket, \$2.60, \$4.50, \$1; The official sales will be found in the table.

Toward the close of the year the developments at some of the Tuscarora mines have been encouraging, but this has not resulted in increased sales of the stocks.

There were 2,300 shares of Belle Isle sold at 45 to 75c.; 1,450 shares of Commonwealth at 25c. to \$1.05; of Navajo, 8,600 shares at 20 to 42c.; of Nevada Queen, 6,400 shares at 15 to 30c.; North Belleisle, 1,708 shares, 20 to 90c.; North Commonwealth, 500 shares, at 75c.

Of other Nevada stocks there were sales of Eureka Consolidated, aggregating 1,740 shares. The stock opened at \$3.50, advanced to \$4 in June, and closed at \$1.50. Mt. Diablo was very quiet, only 1,900 shares being sold at \$1.80 to \$2.65. Tornado Consolidated had but one sale of 500 shares at 15c.

Among the California stocks Astoria, Hollywood and Middle Bar deserve special mention. The official sales lists of the Consolidated Stock & Petroleum Exchange declare that 263,500 shares of Astoria, 247,050 of Middle Bar and 8,200 shares of Hollywood were sold. It is strongly suspected that all these transactions were not *bona fide*. Apropos of these three mines, the Amador Ledger, of December 5th, said: "The Astoria, Hollywood and Middle Bar claims, all close neighbors at the southern extremity of the mineral belt in this county, and all organized into independent corporations for the purpose of stock dealing in New York, are in a state of sound repose as far as the development of their mineral resources are concerned. They are unpatented mines, and for years only sufficient work has been done to satisfy the United States laws. The surface works and underground developments are not worth mentioning. People hereabout pay no attention to the frivolous operations which have distinguished these claims; they cut no figure whatever in the mineral development of this region. It has seemed to us all along that the object is to work off stock on the over-credulous in New York rather than an honest endeavor to search for mineral treasures here."

Our observations of the behavior of these stocks inclines us to the opinion that our contemporary is not far out of the way.

Brunswick Consolidated has not mended its ways. There were alleged sales of thousands of shares weekly which swell up its total sales for the year to the apparently large amount of 176,500 shares. The price ranged pretty much as Mr. H. R. Lounsbery saw fit to have it—it fluctuated between 5 and 16 c. At the close the officials quotations are 5 to 8 c.; an assessment of 2c. per share was levied during the year.

For some reason or other Amador gold which was, as our readers will remember, sold some three years ago to an English company, had a few isolated sales here this year, amounting to 900 shares.

Of Sutter Creek there were sales of 1,900 shares in January at \$1 to \$1.05. It is more than probable that these few transactions were not *bona fide*, but were recorded in order to have something upon which to base the quotations of the stock of the Belmont Gold Mine, a reorganization of the Sutter Creek Company, which was listed on the Exchange subsequently. The Belmont Gold Mine was incorporated on December 13th, 1890, with an assessable capital stock of 500,000 shares of the par value of \$1 each; of this number 400,000 shares were issued in payment of the property, and 100,000 shares placed to the credit of working capital. The latter must be regarded as a 20% stock assessment. It was stated in the application papers that there had been expended on the property (which consists of the Iowa claim, 1,140 by 400 ft.) \$85,000, and in equipment \$15,000. This company was admitted to the Exchange in January,

THE LONDON MINING STOCK MARKET IN 1891.

NAME AND LOCATION OF COMPANY.	Par value.		Opening.		Highest and lowest during the Year.				Closing.		
	£	s.	£	s.	£	s.	d.	£	s.	d.	
Alma, Mex.	1	6	1	6	1	6	5	1	6	2	6
Amador, Cal.	10	10	10	10	10	10	10	10	10	10	10
American Belle, Colo.	2	6	2	6	2	6	4	2	6	4	3
Appalachian, N. C.	10	3	10	3	10	3	6	10	3	10	1
Canadian Phos., Can.	19	3	19	3	19	3	5	19	3	19	9
Colorado United, Colo.	1	9	2	9	2	9	1	2	9	1	3
Cons. Esmeralda, Nev.	1	9	2	9	2	9	1	2	9	1	3
De Lamar, Idaho	1	5	1	5	1	5	1	1	5	1	2
Denver Gold, Colo.	1	5	1	5	1	5	6	1	5	5	5
Dickens-Custer, Idaho	1	1	1	1	1	1	2	1	1	1	1
Elkhorn, Mont.	1	10	1	10	1	10	18	1	10	18	9
East Acreval, Idaho	1	2	1	2	1	2	9	1	2	9	9
El Callao, Venezuela	5	12	6	12	6	12	17	6	12	12	6
Elmore, Idaho	1	2	1	2	1	2	9	1	2	9	9
Garfield, Utah	1	1	1	1	1	1	3	1	1	3	1
Golden Panther	1	16	1	16	1	16	6	1	16	8	1
Golden Gate, Cal.	1	15	1	15	1	15	3	1	15	3	6
Golden Leaf, Mont.	1	1	1	1	1	1	9	1	1	9	3
Jay Hawk, Mont.	1	6	1	6	1	6	9	1	6	9	5
Joséphine, Cal.	1	1	1	1	1	1	6	1	1	6	1
Kohinoor, Colo.	1	2	3	2	3	2	3	2	3	2	3
La Luz, Mex.	1	2	3	2	3	2	3	2	3	2	6
La Valera, Mex.	1	15	1	15	1	15	10	1	15	9	1
Maid of Erin, Colo.	1	10	1	10	1	10	6	1	10	5	1
Mammoth Gold, Ariz.	1	3	3	3	3	3	3	1	3	9	2
Montana Lt., Mont.	1	18	9	18	9	18	9	6	3	8	9
New California, Colo.	1	6	6	6	6	6	1	6	2	6	2
New Consolidated	1	9	9	9	9	9	5	1	9	5	1
New Eberhardt, Nev.	1	1	1	1	1	1	6	1	1	6	2
New Emma S., Utah	1	2	9	2	9	2	5	1	9	1	3
New Flagstaff, Utah	1	7	7	7	7	7	3	7	4	9	1
New Foundland, N. F.	1	3	6	3	6	3	4	3	6	3	9
N. Gold Hill, N. C.	1	1	1	1	1	1	6	1	1	6	9
New Hoover Hill, N. C.	10	1	1	1	1	1	3	2	6	3	3
New Guston, Colo.	3	5	4	5	4	5	2	10	3	10	10
New Russell, N. C.	1	1	1	1	1	1	3	1	1	3	6
New Viola, Idaho	1	1	6	1	6	1	6	1	6	1	3
New La Platta, Colo.	1	1	6	1	6	1	4	6	1	6	1
Old Lout, Colo.	1	1	8	1	8	1	6	1	8	6	8
Palamarco, Mex.	1	5	6	5	6	5	13	6	5	13	10
Parker Gold, N. C.	1	7	6	7	6	7	1	6	7	3	1
Pinos Altos, Mex.	1	7	6	7	6	7	4	6	7	4	6
Pittsburg Con., Nev.	1	8	8	8	8	8	8	9	8	9	2
Richmond Con., Nev.	5	1	10	1	15	1	10	1	15	17	6
Ruby & Dunderberg, Nev.	1	1	3	1	3	1	6	1	3	6	6
San Christian, N. C.	1	1	1	1	1	1	3	1	1	3	1
Sierra Buttes, Cal.	2	5	6	5	6	5	3	6	5	3	7
Sierra Butte-Plum, Eureka, Cal.	10	13	9	13	9	13	9	7	6	12	6
United Mexican, Mex.	1	6	3	6	3	6	2	6	3	6	3
U. S. Placer, Colo.	1	1	9	1	9	1	3	1	9	3	9
West Argentine, Colo.	1	1	2	1	2	1	6	1	2	6	9
Yankee Girl, Colo.	1	15	1	15	1	15	8	1	15	11	3

*December 18, 1891.

FLUCTUATIONS OF PRICES OF MINING STOCKS IN NEW YORK DURING 1891.

Table with columns for Name and Location of Company, Par value, and monthly price fluctuations (High/Low) from January to December, plus a final Sales column. Includes entries like Adams, Colo., Alice, Mont., Allouez, Mich., etc.

‡ Assessment paid.
† Assessment unpaid.

and the Sutter Creek was, at its own request, stricken off the list. Last quotations of Sutter Creek were \$1 to \$1.10, which gave the mine a valuation of \$110,000. Belmont stock when first called was sold at 30 to 31c., giving it a valuation of \$150,000, or about \$40,000 more than Sutter Creek. Then the Belmont's stock commenced a career every whit as eccentric as that of Sutter Creek. Large sales were duly chronicled in the official sales lists of the Exchange, and the price advanced steadily until in October sales were said to have taken place at \$1.05. This would give the company's property a value of \$525,000. In other words, manipulation was rampant, for Belmont at \$1, which is equivalent to Sutter Creek at \$5, something which the latter company's agents here would not have attempted. We should like to know exactly how many shares of Belmont really have changed hands at the Exchange. According to the official lists the number of shares sold was 74,050. The closing quotations are 74c. to 75c., and we would like to know whether the property has some intrinsic value.

Syndicate was neglected; during the year there were only a few unimportant sales at 10 to 15c.

Bodie Consolidated underwent a steady decline brought about by the levying of assessments. It opened at \$1, advanced in February to \$1.45, and closed at 60c., with total sales of 6,948 shares.

The stock of Mono behaved exactly like Bodie, only it was in less demand. It opened at 70c., declined to 10c. (assessment paid), and closed at 40c., with sales of 1,100 shares during the year.

Bulwer opened at 25c.; it advanced in February to 57c., and closed at 25c., with sales of 9,150 shares.

The Standard Consolidated was one of the few California stocks which attracted attention, based on developments at its mine. The stock opened at \$1.40 to \$1.75. The general dullness of the market caused it to decline to 90c. in May, but at the close it rallied, due to the payment of dividend, and has since ruled steady and firm at \$1.10 to \$1.15. There were sold 18,285 shares.

North Standard had only one sale of 100 shares in May at 8c. Some reckless person saw fit to startle the Exchange by this transaction in a stock which is never dealt in nowadays.

Plymouth Consolidated was in moderate demand during the year, the comparatively small sales being due to the fact that the stock is closely held by a few people. It opened at \$2 to \$2.50, and in October, owing to the numerous rumors of a strike, it sold as high as \$3.25. The officers of the company persistently denied the news of a strike, and as the excitement abated the stock declined, finally closing at \$2 to \$2.50, which is exactly the opening price.

Quicksilver Mining Company's stock was not dealt in until October, when the preferred stock sold for \$21 to \$23 and the Common for \$4.50 to \$5. Total shares sold during the year: Preferred 2,100 shares, and Common 1,200 shares. Closing prices are respectively.

The Colorado stocks certainly are among the most popular of those listed at the Exchange. Adams Consolidated showed but few fluctuations. The lowest price recorded, \$1.65, was in January. It closed firm at \$1.90 to \$1.95, having sold for \$2 in September. This mine is worked on lease by the Maid of Erin Silver Mines, Ltd., an English enterprise. The royalties received by the Adams Company have enabled it to declare regular monthly dividends of \$7,500, 5c. per share. There were 5,850 shares sold during the year.

American Flag opened at 5c., declined to 2c. and closed at 3c. There were only 2,900 shares sold. This, as we have often stated, is a bare faced fraud. Aspen, for some reason or other, has never been very popular in this market. The stock opened at \$7 in February. Owing to the cessation of dividends it declined to \$2.50 in May. In August a few sales were made at \$4 to \$5. Number of shares sold 2,720.

Transactions in Brece during the year aggregated 2,100 shares. The stock opened at 40c., declined to 31c. in May, and closed at about 40 to 45c.

Catalpa had a few transactions at 30c. and 23c., the latter being the closing price. Chrysolite ranged between 18c. and 25c. Total sales, 8,360 shares.

Colorado Central ruled at \$1.25 to \$1.50, the sales at the latter figure being very small. There was but little demand for it.

Crescent had sales at 12c. to 17c., aggregating 3,200 shares. These old mines have not been in much demand, the speculative element having been small.

Dunkin was neglected, only 100 shares at 65c. being sold. Freeland, in the official sales lists of the Consolidated Stock and Petroleum Exchange, is set down as having disposed of 93,600 shares, at prices ranging from 30c. at the opening to 5c. at the close. The prevalent opinion is that these apparently large sales were chiefly "washed." The former eccentric behavior of this stock, and the fact that the company's property was sold at sheriff's sale some time ago, lend an air of probability to the rumors.

During the year 4,600 shares of Iron Silver were sold at from \$1.05 to \$1.75, the stock closing in the neighborhood of \$1.50. Lacrosse to all appearances was traded in to the extent of 8,700 shares at 5c. to 7c.

Leadville Consolidated was one of the favorites, 140,012 shares being sold. The price ruled fairly steady at 12 to 13 cents. A dividend of 3c. per share sent the stock up to 17c. It closed at 12 to 14c.

Little Chief opened at 38 and closed at 25 with fairly large transactions, about 25,700 shares changing hands.

Monitor opened at 5c. and closed at 2c. It was in little request.

The same may be said of Phoenix Lead at 10 to 14c.

Robinson opened at 30c. and advanced in May to 60c. At the close the stock sold at 40 to 45c. There were sundry rumors about strikes and other good things at the property, but the officers of the company have volunteered no information. Shares sold, 12,426.

Silver Cord was in fair demand. The price ranged between 20 to 35 cents, closing at 25 cents. There were 4,200 shares sold.

Small Hopes was rather neglected, whole months passing without the occurrence of a single sale. The price in January was 87c. and in July, 70c. Since then no sales have been made.

Ward Consolidated was in no request, total sales aggregating only 100 shares.

Among the Black Hills stocks, Caledonia opened at 50c., advanced to \$1 in May and declined subsequently, closing at 54c., with sales during the year of 9,750 shares. Deadwood Terra made a good record for itself; the opening price was 75c., due to the payment of regular dividends; it

advanced to \$2.10 in September, and closes firm at \$1.75 to \$2. Father DeSmet was lightly traded in. It opened at 41c., advanced to 49c. and declined to 20c., with sales of 2,700 shares. Homestake stock is almost all held by persons who recognized in it the possession of a "good thing;" few shares were sold during the year; the stock rose from \$9 in January to \$11.50 in October. This company has declared regular monthly dividends of 10c. a share. Iron Hill was not in much demand, few shares being sold. The price ranged from 16 to 40c. Sullivan Consolidated was lightly dealt in during the summer, 3,100 shares being sold at 35 to 40c.

There have been renewed rumors of a highly uncomplimentary character concerning the source from which the Highland mill gets its ore. It has been more than intimated that the rich ores of the Homestake mine go to the Highland mill, which is owned by only some of the stockholders of the Homestake, and which makes no returns of its bullion output; in other words, these rumors call this "the little joker" of the Homestake. Can such things be under this administration?

Of the Montana stocks listed at the Consolidated Stock and Petroleum Exchange, Butte & Boston shows sales of 100 shares at \$15.88. Boston & Montana was in better demand; there were 380 shares sold at \$39.50 to \$44.50, the latter price obtaining in June. The once popular Moulton has fallen into desuetude, the sales this year amounting but to 500 shares at 30 to 40c. Alice remained one of the favorites; it was firm at \$1.35 to \$2; total sales, 11,590.

Of the three Utah stocks at the exchange Stormont was in no demand, only a few sales taking place during the early part of the year, at 5 to 7c. Ontario is too high priced ever to become very popular in this market. There were sales amounting to 1,937 shares at \$39 to \$45, truly a good advance, but no greater than this stock deserves, for the Company has continued its magnificent work of declaring its monthly dividends of \$75,000. Horn Silver was one of the most popular of all the stocks on the lists; total sales aggregated 40,853 shares at \$2.70 in the beginning, to \$4 at the close.

Of the New Mexico stocks, Santa Fe shows sales of only 400 shares at 65c. and 35c., the latter being the last recorded price. Silver Mining of Lake Valley declined from \$1.05 in January to 40c. in September. Number of shares sold in 1891 was 3,000, against 15,460 in 1890.

The few Idaho stocks at the exchange are low in prices, but it is intimated that even the quotations made are too high for the stock. Of Castle Creek 16,700 shares changed hands at 1 to 4c. Columbia and Beaver, 700 shares at 2 to 3c.; Holyoke, 2,300 shares at 3 to 6c.; Shoshone, 4,800 shares at 1 and 2c., the latter being a price the extravagance of which has been discussed wonderingly.

Among the Arizona stocks Phoenix was the most popular. The management of this company is made up of people who, having reputations to lose, are above reproach. There were sold during the year 123,900 shares at 35 to 70c.; the closing price is from 40 to 50c. Silver Queen was neglected, only a few small transactions taking place from 2 to 4c. Silver King opened at 20c., and declined to 4c. (assessment paid). Then in November came the news of a strike, which sent the stock up to 85c.

Mutual Smelting and Mining Company, of Washington, was apparently in some demand during the first part of the year. The price declined from \$1.50 in January to 50c. at the close. Total transactions reported by the Exchange aggregate 29,200 shares. Well informed brokers have stated in our hearing that it is highly probable that the actual sales of this stock fell far below those recorded officially.

The trading in the Michigan copper stocks, which last year promised to become a permanent institution at this exchange, has fallen into desuetude. During the early part of the year there were a few unimportant sales of Allouez at \$3 to \$3.50; Atlantic at \$14.13 to \$17.13; Calumet & Hecla at \$247.50 to \$261.25; Franklin at \$16.25 to \$17.88; Huron at \$2.75 to \$3.88; Kearsarge at \$11.38 to \$11.88; Osceola at \$35.12 to \$45.50, and Tamarack at \$140 to \$146.

Of Minnesota Iron Company a few shares changed hands at \$80.

Rappahannock, Mr. J. A. Macpherson's pet, was not dealt in heavily this year; there were only 11,200 shares sold at 1 to 4c.

Augusta Mining and Investment Company, owning real estate and mining property in various Southern States, filed application for listing early in the year. The company has an authorized value of \$2,500,000 in 100,000 shares of \$25 each, and an actual capital of \$1,250,000, divided into 50,000 shares of \$25 each, full paid and non-assessable. There were in the treasury \$92,000 in stock and \$58,000 in bonds. This company was admitted April 30th. On calls the stock was placed at \$15 to \$15.25 and the bonds at 90%. During the year there were 1,100 shares of the stock sold at \$15.38 and \$16. A few of the bonds also changed hands at 90 to 25%. It is probable that the stock and bonds of this company have been sold privately and not recorded at the Consolidated Stock and Petroleum Exchange.

Of the foreign mining companies, El Cristo, the South American company of which Mr. Harpending is the head, disposed of 24,400 shares at 25 to 65 cents. During the year there were numerous rumors concerning this property, none of which have resulted in anything substantial. The English syndicate report did duty as usual, but we are assured that there is nothing in it; at the present writing developments at the mines are nil. Considering that the property is regarded as valuable in the Republic of Columbia, where it is located, the reason for the absence of active developments is not plain. Mr. Harpending, who continues the sphinx of yore, does not volunteer to elucidate this matter, which, after all, may prove to be only a case of lack of the wherewithal.

San Sebastian, of Salvador, was dealt in desultorily to the extent of 1,500 shares at 8 to 10 cents.

NEW YORK COAL STOCKS IN 1891.

In 1890 we had a financial earthquake which disturbed the entire civilized world. It was known a year ago that the disaster was great, but it was only upon carefully examining the ruins that its real extent was learned. Those crippled were more numerous and more prominent in the financial world than was at first supposed, and the after developments and urgent liquidations of this class have checked all bull movements in securities excepting the one which developed force late in the present year.

The movement in stocks, which culminated in September, gave evidence of speculative material in this country, and though Mr. Gould received

much abuse at that time because Missouri Pacific passed its dividend and the price of the stock declined some 20%, carrying the rest of the market down with it, still we cannot but look upon that occurrence as very fortunate in view of the developments since in reference to the financial condition of some of the largest railway corporations in this country. The speculation at that time was developing a wildness which must have resulted in a great collapse in a few months, without benefit to any except a class of speculators and leaving us in a disturbed and unsettled condition on Wall Street, in the face of general prosperity throughout the country.

The year closed with a good demand for railroad bonds and prospects of its continuance into 1892 upon a much enlarged scale. The railroad situation cannot be a satisfactory one until many of the companies and their bankers are permitted to float millions of dollars of bonds which have been carried in some cases for years. Such an event would supply funds to that class which always leads a big speculative movement, and, by new ventures, gives an impetus to all branches of trade.

Among the countries with stable government it is very clear that America is now the most popular with investors. There was never a time when wealth was not accumulating in the world, and although 1891 was generally an unsettled year and much fictitious wealth disappeared, still there was a large accumulation of actual wealth, and there will be a great deal of money for investment in 1892. There are already signs that Great Britain and the Continent will take many millions of our bonds, and evidence is not lacking that they will figure quite extensively in gambling in our stocks. This, combined with a growing speculative feeling in this country, should develop with us an upward movement in values, especially as it is warranted by the agricultural, manufacturing and commercial conditions.

During the past year the coal stocks were without special feature, rising and falling with the rest of the market. At the end of this year, however, they showed hesitation. This was due to prospective trouble in the coal trade.

The time has come for a revision of the business. The Reading com-

The Jersey Central Company, while being the greatest loser by the transfer of Coxie Bros. & Co.'s business, is the most outspoken in its determination to refuse to give the Reading Company any increase in tonnage, not even the business which has already been taken from it in the transfer of Coxie Bros. & Co.'s tonnage.

A great element in all questions relating to the coal trade is the personal and selfish interests of many of the officers and others prominently identified with the companies. These gentlemen, unfortunately for the trade and the majority of stockholders, are usually heavy speculators in the coal stocks. The Reading officials are justified in demanding an increased production, because without it the stock of their company can have no actual value for years. The officers of the Jersey Central Railroad Company are justified in opposing the Reading's demand, as they are supposed to be large holders of the stock of their own company, and a loss of a business equal to at least 500,000 tons per annum would be a serious matter to them.

As to the officers of the other companies, they are probably not holders of their own stocks to such an extent that they could not sell out before entering on a war policy in which it might be to their personal advantage to seek a break in their stocks. This thing has occurred in the past a great many times, and will certainly occur again if the opportunity offers.

The above remarks are thrown out as a hint to holders of the coal stocks, but not with advice to either purchase or sell pending the adjustment of the prospective contest.

Cameron Coal Company still continued to furnish an occasional quotation. This stock has demonstrated in the past the gullibility of the American public as completely as any stock that ever was dealt in on the Stock Exchange.

Columbus & Hocking Coal has been featureless during the past year. The failures of 1890 have left this company without a progressive ownership. Developments are probable in the early future which may give new life to this company. The inability to arrive at a satisfactory ar-

PRICES OF COAL STOCKS IN NEW YORK DURING 1891.

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.		
Cambria Iron.....									77.00	75.00	75.00	75.00	74.00					77.50		77.50	75.00	74.00	72.88	73.00	72.88	1,446
Cameron Coal.....									1.00		1.00						1.00		3.00	1.50		1.88	1.38	1.75	.50	2,350
Col. & Hocking Coal.....	19.38	17.50	18.00	16.63	18.75	15.00	17.50	15.13	16.00	15.00	15.63	15.00	14.00	17.00	14.50	17.00	16.00	16.50	15.13	15.00						12,510
Col. C. & I.....	38.63	33.00	38.25	35.13	39.75	34.25	39.25	35.75	59.50	34.50	36.00	30.13	34.50	27.50	36.25	29.00	38.75	34.25	38.38	35.50	36.63	34.00	37.00	33.25		202,450
Consolidation Coal.....	26.00	25.00			24.00	23.00																				30
Det. & Hudson Canal.....	136.50	130.25	139.63	133.00	134.25	129.25	135.75	132.50	136.50	130.13	130.25	126.00	129.75	136.00	135.25	124.88	140.38	133.38	130.75	130.75	129.75	120.50	124.75	120.25		214,227
D. L. & W. R. R.....	139.38	131.00	140.38	136.75	137.75	133.00	139.38	134.50	140.25	134.50	137.25	133.25	142.25	130.38	142.25	130.50	145.63	140.00	141.13	139.63	140.25	136.50	141.50	136.13		2,176,938
Hocking Valley.....	29.00	25.75	28.00	26.00	27.50	24.50	28.25	24.00	29.50	26.00	26.13	23.50	25.00	22.00	28.38	23.00	34.75	27.00	34.50	31.50	31.50	28.00	31.00	27.13		221,000
Hunt & Broad Top.....	20.50	18.00	23.00	21.00	22.63	21.00	21.50	21.00	24.50	23.25	25.00	23.50	24.25	22.50	24.00	20.50	28.13	24.00	26.00	24.00	25.25	24.75	27.75	24.00		31,230
Lehigh Coal & Nav.....	48.50	47.50	48.75	47.13	47.75	46.00	48.50	46.13	47.50	46.50	47.00	46.00	47.00	46.00	49.63	46.00	50.13	48.88	50.38	48.63	50.00	47.75	49.25	47.88		16,808
Lehigh Valley.....	50.88	49.00	51.00	49.88	51.00	46.25	48.88	47.75	48.62	47.88	47.88	45.88	48.00	46.25	50.25	47.00	51.25	49.50	51.25	49.00	50.13	48.75	50.25	48.75		70,449
Mahoning Coal.....	85.00								77.00	75.00																1,345
Maryland Coal.....	17.50	15.25	17.00	16.00	16.50	15.25	17.75	15.50	19.63	17.50	19.00	17.50	19.00	18.13	20.50	18.50	22.00	21.00	22.00	21.00	23.00	22.50	25.00	22.50		554
Morris & Essex.....	147.00	145.00	147.63	146.00	148.50	143.00	148.25	143.00	148.25	144.50	141.00	140.00	142.00	137.50	145.00	142.00	144.00	141.50	144.75	142.50	145.00	143.00	144.88	141.25		14,033
New Central Coal.....	12.00	10.75	12.00	10.00	10.50	9.75	11.13	9.75	10.75	10.50				10.25	9.50	11.50	10.00	13.00	11.00	12.50	12.00	10.50	12.00	11.50		7,055
N. J. C. R. R.....	118.00	106.00	119.75	111.00	117.00	112.75	122.75	114.50	121.25	113.00	115.00	105.25	115.75	106.13	120.00	108.00	121.00	117.38	119.50	114.50	115.50	110.00	114.50	111.50		305,526
N. Y. & Perry C. & I.....	9.63	7.75	11.25	8.38	8.88	8.00	8.50	8.00	8.38	7.50	7.75	7.00	7.13	6.63	9.00	6.75	11.50	8.00	11.38	10.00	9.63	8.50	10.13	9.00		141,668
N. Y. Susq. & West.....	36.63	23.13	40.25	31.00	33.75	31.25	33.50	31.00	33.25	28.00	28.25	27.00	28.25	26.00	33.38	25.00	40.25	32.00	41.25	37.00	37.50	34.50	40.50	37.50		149,508
Norfolk & West. R. R.....	16.75	14.13	16.50	16.00	15.50	13.38	15.13	14.50	16.75	16.00	15.00	14.00			17.50	13.00	18.00	16.50	18.75	18.00	18.50					21,927
Pennsylvania Coal.....	57.50	53.50	56.25	54.25	54.38	52.75	56.13	53.25	56.50	51.25	53.00	50.50	52.00	46.75	55.00	46.50	55.75	53.25	56.75	53.13	51.88	49.75	53.38	50.50		29,319
Pennsylvania R. R.....	52.63	50.38	52.00	51.13	51.75	50.88	53.00	51.38	51.75	50.00	50.25	49.88	50.63	49.88	54.25	49.88	55.00	53.25	56.00	54.13	54.88	53.38	56.88	54.50		295,570
Phila. & Reading R. R.....	34.63	31.00	34.75	31.50	32.25	28.38	34.38	30.00	30.88	32.25	27.88	29.38	26.00	35.75	25.88	43.38	33.63	42.13	38.25	39.88	36.50	40.00	37.75	3,558,923		11,225
Tennessee C. & I.....	39.50	32.38	37.25	35.25	36.00	33.50	37.50	34.00	36.50	32.00	35.00	30.25	34.00	24.50	34.50	25.25	37.38	32.00	41.75	36.00	39.88	35.50	40.00	38.00		245,127
Westmoreland Coal.....	85.00	80.00	86.00						88.00	87.00				85.00	85.00											3,270
Total sales.....																										7,790,938

† Ex-dividend. § Allocations full paid.

pany wants a greater percentage of the total output. In fact, it must have it. Reading stock at about 40% for voting purposes alone is a very great luxury, and the income bonds are but little better. Neither will be worth much unless the company can increase its business materially, as it is evident that the rates for carrying coal are bound to fall off, and only a large increase in tonnage will permit the company to increase its net earnings.

In years past, whenever the question of percentages was raised, it was found that the aggregate of the percentages which the companies thought they were entitled to generally equalled from 125% to 150%, with only 100% for distribution. It is probable that the same conditions will prevail this time. We cannot see how a satisfactory division can be arrived at without something of a contest which will thoroughly disturb the coal trade for a time and probably alarm some of the owners of the securities of the coal companies. Outside of Reading, the coal stocks are generally so well held that they become dangerous properties for the bears to deal with, and still, when alarm does set in, there are no stocks that become so panicky.

The anthracite coal properties are very valuable and the trade is bound to adjust itself to the changing conditions, and if we are to have the great bull market which is generally expected, the stocks of these companies will figure in it before the end of 1892. The indications are that the output for 1892 will be somewhere near 43,000,000 tons. A continued coal war would mean that the companies would have to take at least \$43,000,000 less money for their product and its transportation under a war than if working in harmony. The war is not likely to be of great duration.

The Reading Company opens the war by adding Coxie Bros. & Co.'s business to its own percentage. That firm is developing some large collieries, and it is thought that the business to be given the Reading company will equal 1,500,000 tons in 1892, or say 3½% of 43,000,000 tons. It is supposed and stated that the Reading Company will ask for a still greater increase in its percentage.

range for the regulation of the trade in Ohio is a serious difficulty. Its great business is mining and selling coal, and with some understanding with the competitive interests profits should be increased all around.

Colorado Coal and Iron has been a disappointment to its friends. This is largely due to the demoralized condition of the iron trade.

The Columbus & Hocking Valley Railroad Company's stock closed about as it was at the beginning of the year. The earnings under the present management have shown a gratifying increase, and should 1892 prove to be what is expected of it, it is not improbable that this stock will sell very much higher. Messrs. Samuel D. Davis & Co. are at the head of the deal, and while conservative are quite able to advance the stock considerably.

Maryland Coal has resumed the payment of dividends, and has been one of the features of the market for coal stocks.

THE PARIS MINING STOCK MARKET IN 1891.

Name and Location of Company.	Opening. Francs.	Highest. Francs.	Lowest. Francs.	Closing. Francs.
Belmez, Spain.....	819.00	870.00	795.00	870.00
Callao, Venezuela.....	50.00	50.00	16.50	11.00
Callao, B. Venezuela.....	5.50	15.00	5.50	13.00
Eastern Oregon.....	6.00	6.00	2.00	2.00
Forest Hill Divide, Cal.....		85.00	60.00	60.00
Golden River, Cal.....	130.00	150.00	120.00	120.00
Golden River, parts.....	30.00	30.00	20.00	20.00
Laurium.....		787.50	700.00	780.00
Lexington, Mont.....	102.50	137.50	85.00	137.50
Lexington, parts.....	3.00	4.00	2.50	4.00
Nickel.....		860.00	805.00	860.00
Rio Tinto, Spain.....	598.75	598.75	410.00	410.00
Rio Tinto, Oblig.....		517.50	510.00	517.50
Rio Tinto, Oblig.....		512.50		512.50
Tharsis, Spain.....	155.00	173.25	140.00	151.00
Vieille Montagne.....		547.50	510.00	522.00

THE PITTSBURG STOCK MARKET IN 1891.

From our Special Correspondent.

The year 1891 was marked by extensive liquidation in the stock market and contraction in general business. The latter, measured by the Clearing-House yard-stick, amounted to \$110,000,000, the total exchanges footing up \$676,000,000, against \$786,694,231 in 1890. The falling off was due to the long continued labor troubles in the building trades, the coal and coke strikes, the shutting down of blast furnaces, and the depression in the iron and steel market. The liquidation in stocks was forced by the monetary stringency and the distrust which prevailed in financial and business circles early in the year. It was quite severe in the Westinghouse properties, one of the most important of which—the Electric and Manufacturing Company—was making a hard struggle to avoid a receivership; but even gilt-edged bank stocks and railroad bonds were affected, and in some instances the lowest quotations for years were recorded.

The Lustre Gold Mining Company's stock continued to be the active feature of the mining list, but like everything else it shows a material shrinkage in value. On April 3d the capital stock of the company was increased from \$150,000 to \$200,000, and the money used in developing the property. New work on the latter included the sinking of new shafts 170 ft. and the driving of two adits 180 ft., besides extending the former levels, from which the principal ores have been taken. Additions to the plant during the year consisted of a steam hoist, six concentrators, one Griffin mill and one set of rolls, increasing the capacity about threefold. The company is at present erecting a chlorination plant for the treatment of concentrates, the daily output of which is about 10 tons. Several shipments of bullion were made during the past 12 months, but as yet no dividends have been paid. The market price of the stock, which for three years past has ruled at a premium ranging from 20% to 200%, declined in December this year below par.

Hidalgo Mining Company was moderately traded in within the range of \$3 to \$6 (par \$10), the recent advance to the latter figure being based

production, and the two first named are now paying regular dividends at the rate of 6% per annum on par value.

One of the most noteworthy events of the year was the successful reorganization of the Westinghouse Electric and Manufacturing Company. Its financial difficulties began early in 1890, and were precipitated by the panic which occurred in the fall of that year. Its utter collapse seemed so inevitable that Pittsburg financiers refused it assistance. Mr. George Westinghouse, Jr., its president, finally interested a syndicate of New York and Boston bankers in the enterprise, and after a struggle lasting for fifteen months he was able to announce in November last a complete reorganization on a sound basis, and with ample working capital. Its present capital is \$6,000,000 common stock, and \$4,000,000 7% cumulative, preferred stock, about \$1,000,000 of the latter remaining in the treasury for future contingencies. The extensive plant in this city is now in full operation. The affairs of this company were so intimately connected with those of the Union Switch and Signal Company, the Standard Underground Cable Company and the Westinghouse Air Brake Company that its improved condition will doubtless have a good effect upon this entire group of securities, which is widely distributed in this market.

Perhaps the most important department of the Pittsburg market, and the one promising the largest field for investment and speculation, is that representing street railway securities. Within the period under review; three lines—the Duquesne, the Pittsburg & Birmingham and the Pittsburg, Allegheny & Manchester—put into operation the electric system, leaving but two comparatively small roads which still use horses. Careful estimates from official sources show that the street railways of Pittsburg and Allegheny City are to-day carrying at the rate of 62,000,000 passengers per year, and that the net earnings from this traffic are equivalent to 5% on the combined stocks and bonds of all the lines. The traffic of course is not equally divided, and the market value of the various securities range from \$60 to \$61 for Citizens' Traction stock, which pays 6% on par (\$50), to \$17@20 for Duquesne Traction (par \$50), which is a non-dividend payer. The bonds, which are all long-term 5 per cents., range from 106½ to 108 for Citizens to 92 to 95 for Duquesne. It is admitted that

FLUCTUATIONS IN PRICES OF STOCKS IN PITTSBURG DURING 1891.

NAME OF COMPANY.	Par val.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
		H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.
Mining.																									
Consignee, N. M.	1.00	.25	.50	.20	.50	.20	.50	.20	.50	.20	.50	.20	.50	.20	.50	.20	.50	.20	.50	.20	.50	.20	.50	.20	.50
Hidalgo	25	21	15	27	15	35	25	50	25	10	25	40	30	10	25	42	30	50	30	35	25	30	25	30	25
La Noria, Mex.	25	21.00	18.13	21.25	20.00	16.00	14.50	11.25	12.25	11.50	12.00	13.13	12.75	13.13	12.63	11.00	11.88	12.25	11.25	12.50	11.25	11.50	10.50	10.88	7.88
Lustre Mfg., Mex.	50	38.00	34.50	.....	.....	10.00	38.00	10.00	36.00	40.00	37.00	40.40	37.00	40.00	.....	10.09	37.50	41.00	36.50	41.00	36.50	43.00	41.00	43.50	.....
New York & Cleveland	10	.....	.....	2.00	1.00	1.88	.88	2.00	1.63	2.00	1.75	2.00	1.75	2.00	1.50	2.13	1.75	1.75	.....	3.25	2.63	3.00	2.50	3.00	2.50
Red Cloud	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Silverton, Colo.	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Natural Gas.																									
Allegheny (Illuminating)	25	40.00	.....	.....	.....	.....	.....	.....	.....	45.00	44.00	43.00	42.00	43.00	42.00	43.50	42.00	43.50	42.00	43.00	42.00	43.00	42.00	43.00	42.00
Bridgewater	100	.....	.....	18.00	25.00	48.00	15.00	18.00	15.00	48.00	15.00	48.00	15.00	48.00	15.00	48.00	15.00	48.00	15.00	48.00	15.00	48.00	15.00	48.00	15.00
Chartiers Valley	100	14.25	8.00	10.00	9.00	10.00	6.25	10.50	6.25	10.00	6.00	9.38	8.75	13.00	.....	9.38	8.75	9.50	4.50	6.00	4.50	6.50	5.75	8.50	5.50
Consolidated Gas (Illum.)	50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Manufacturers	50	25.00	20.00	25.00	20.00	25.00	20.00	25.00	19.00	29.00	23.50	25.00	24.00	25.00	24.00	26.00	24.00	25.00	24.00	25.50	24.00	28.00	25.00	27.00	25.00
Natural Gas Co., of W. Va.	100	65.00	.....	60.00	57.50	60.00	57.50	60.00	57.50	60.00	57.50	60.00	57.50	60.00	57.50	60.00	57.50	60.00	57.50	60.00	57.50	60.00	57.50	60.00	57.50
Ohio Valley	50	25.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pennsylvania	50	9.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
People's Pipeage Co.	50	11.00	6.00	7.75	7.25	10.50	7.25	11.00	9.00	11.50	9.00	10.70	9.00	10.60	7.25	8.25	7.25	8.25	7.25	7.50	6.25	8.00	6.50	12.00	7.00
People's	50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Philadelphia	50	13.00	8.75	13.75	10.00	13.50	10.50	13.25	11.50	14.00	12.00	13.63	11.50	12.25	10.75	12.00	10.50	12.00	10.75	12.50	10.50	13.25	11.00	13.75	12.8
Pine Run	100	35.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pittsburg (Illuminating)	50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
South Side (Illuminating)	25	26.00	25.25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Westmoreland & Cambria	50	18.00	17.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wheeling	50	15.00	12.00	16.00	16.13	16.00	13.00	17.00	13.00	20.00	13.50	22.00	20.00	22.00	20.00	25.00	20.00	22.00	20.50	21.50	20.00	22.00	21.00	24.00	20.00
Oil.																									
Columbia	10	3.00	2.00	3.00	1.00	3.00	1.00	3.00	1.00	3.00	1.00	3.00	1.00	2.00	.....	2.25	1.50	2.25	1.50	2.00	1.25	.....	.....	.....	.....
Tuna	50	65.00	60.00	60.00	55.00	60.00	55.00	60.00	55.00	60.00	55.00	60.00	55.00	55.00	.....	55.00	53.50	54.75	53.50	50.00	45.00	.....	.....	.....	.....
Washington	100	90.00	85.00	85.00	80.00	85.00	80.00	85.00	80.00	91.50	70.00	91.50	.....	91.50	.....	91.50	.....	91.50	.....	.....	.....	.....	.....	.....	.....
Machinery.																									
Westinghouse Air Brake	50	19.00	90.00	100.00	91.00	93.00	92.00	95.00	90.50	96.00	90.50	95.50	91.50	95.50	91.75	105.00	99.00	111.00	108.25	107.00	104.00	104.00	102.50	102.00	98.75
Westhouse Brake L't'd.	50	74.00	68.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Westhouse Electric Co.	40	13.88	6.50	17.25	8.50	13.00	10.25	11.50	11.50	16.00	13.00	13.63	12.88	13.25	10.88	11.00	10.50	15.00	13.00	16.00	13.00	13.50	10.00	13.00	11.00

upon a report that the company will begin the payment of regular dividends early in the new year. La Noria, which a few years ago was the craze alike with the bank president and the office boy, has been dull at 18c. to 35c. (par \$25). Its property, as previously noted in the ENGINEERING AND MINING JOURNAL, has been leased for a term of ten years to the Motolinia Developing Company. The latter last month called in the final assessment on its stock, and reported encouragingly on the progress of its work.

In September the stock of the Red Cloud Mining Company was listed on the Exchange. It is a comparatively new company, incorporated under the laws of Idaho, with a capital of \$1,000,000, divided into 200,000 shares of the par value of \$5. Since October, 1890, to date it has paid about \$100,000 in dividends. The stock is quoted at \$2½ to \$3.

As will be noted in the table accompanying this review, quotations on natural gas stocks declined to the basis of ordinary mining shares. Some improvement has recently taken place, however, and the outlook for several of these properties is more promising to day than at any previous time in the past 18 months. Philadelphia Company, which is the largest natural gas corporation in the United States, was fortunate in developing four new gas fields contiguous to the city. These are the McGahey on the southeast, the Elizabeth on the east, the Moon township on the southwest and the Franklin and Ohio township field on the northwest. To these fields 10 miles of new 16-in. mains and 5 miles of 20-in. mains were laid, and in addition 16 miles of old 8, 10, 12 and 16 in. mains were taken up in abandoned districts and relaid. The total mileage of lines owned, leased and operated by the Philadelphia Company, including service pipes, is now between 700 and 800 miles. The proximity of the new fields to the points of consumption insures a better distribution and supply of gas, and the pressure has been largely increased. The company has paid no dividends during the year, but the question of resuming them not later than April, 1892, has been informally discussed by the board of directors. Of the other natural gas companies, Wheeling, Manufacturers', and Bridgewater derive a considerable revenue from their oil

there has been considerable inflation in the reorganization of the various companies, but the phenomenal growth in traffic following the introduction of rapid transit facilities will soon place all the stocks on a dividend-paying basis.

At the close of the year financial conditions show a vast improvement. The iron and steel trades are at last feeling the effects of the prosperity of the railroads; the river coal trade is more prosperous than for 10 years past; the development of the wonderful McDonald oil field, within 10 miles of the Stock Exchange, has attracted new capital thither; the discovery of the new gas fields has at least extended the life and usefulness of several large corporate properties; and, finally, the ease in money and the establishment of credit upon a firmer basis, after the strain of the past 18 months, cannot but have a stimulating effect upon the stock market.

THE SALT LAKE MINING STOCK MARKET IN 1891.

From our Special Correspondent.

The close of 1891 in this market has been characterized more by intense dullness in mining stocks than any other feature, and seems irremediable unless the financial condition of the country takes a decided change. The first of the year was marked by some sharp declines and equally sudden advances, but the market soon settled down to its natural basis, and but few ripples have since caused it to flow otherwise than in the even tenor of its way. This inactivity, which means death to all trading, and especially in mining stocks, disgusted the operators and forced the local stock board to suspend "calls" on October 21st for an indefinite period. I fear the suspension is permanent. An effort is now being made to organize an exchange, to be known as the "Utah Stock Board," whose object will be "primarily, the development of the prospects of the Rocky Mountain region, and dealing in the stocks of the undeveloped mining properties which need the encouragement of capital to bring them upon a paying basis." The success of such an exchange is questionable.

Alice opened at \$1.90, touched its lowest point, \$1.40, in March, and closed at \$1.50.

The Park City mining stocks are mostly investment securities, high priced, and trading in them limited. Alliance opened at \$1.80, advanced to \$2.50 in June, declined to 80 cents in September and closed steady at \$1.

Of the Pentic stocks, Mammoth, which started in the first of the year at \$4.25, and, as a regular monthly dividend payer of 10 cents a share, was quite active.

We are ruled by the New York quotations on Horn Silver. A great deal of this stock has changed hands here during the year.

Street trading is quite brisk, and our investment stocks are in great demand. We can show a record of about \$1,000,000 in dividends paid this year from our incorporated companies alone, which demonstrates the value of Utah mining shares.

have been bountiful—in no appreciable measure explains the dullness of mining shares, but there does not seem to be any hope that with money more free the stock market will show any particular stimulation.

A history of the stock market must necessarily be a review of the fortunes of the Comstock, and as the mines have been administered for the benefit of the few as against the many, it can be readily understood that outside investors have taken gambler's chances when investing.

Table with 4 columns: Name, Assessments, Dividends, Total. Lists companies like Belcher, Confidence, California, etc., with their respective financial figures.

From the above list it would seem as if in the case of eight mines the stockholders would have been in pocket very handsomely if the properties had never been worked.

There is a prospect, however, of a better state of things during the year just opening. Stockholders are focussing their demands for reform in the administration of mining properties in a legitimate manner and through legitimate channels.

Prices, almost without exception, closed lower than at the opening of 1891. During the year nothing occurred to break the dull monotony of what was practically a "chippers'" market except the deal in Consolidated Californian & Virginia, which sailed so high that the entire market was

THE SAN FRANCISCO STOCK MARKET IN 1891.

From our Special Correspondent.

A review of the mining share market reveals little that has been of interest, or, indeed, of profit during the year 1891. The promises held forth when the year opened that the exploration work being done in several of the Comstock mines would result in the uncovering of ore bodies sufficiently important to stimulate interest and activity in the stocks of all the mines on the lode have not been fulfilled.

FLUCTUATIONS OF PRICES OF MINING STOCKS IN SAN FRANCISCO DURING 1891.

Large table with columns for months (January to December) and sub-columns for High (H) and Low (L) prices. Lists various mining companies like Alpha, Alta, Andes, Belcher, etc., with their price fluctuations throughout the year.

carried along, and shares having no intrinsic value sold at a comparatively handsome figure. The pivotal stock opened in January, heavy in no great demand, selling as low as \$2.10. There was no reason, seemingly, for the depression, for the battery assay value of ore being taken from the mine had increased each week in December 1890. In February the advance began, and, although the fluctuations were wide, the general trend of the price of the stock was upward until May when the highest point was reached—\$20.50. During April, May and June there was an advance along the entire line of Comstock in consequence of the strength shown by Consolidated California & Virginia, and trading was very active. The other north enders were also in demand. Ophir, that has been in favor throughout the year, rose to \$8.12 in April, and sold very freely in May, during the "boom", at \$9.50. During the same time Sierra Nevada sold for \$4.50; and Union Consolidated for \$5.

Of the middle group of Comstocks Potosi was the favorite early in the year, but the expectations of great things held out never materialized, and this stock, with the exception of one or two spurts of activity, has not been heavily dealt in. In March it touched \$6.00 and gradually receded, but later jumped from \$3.75 to \$6.75 in August. Thence on it declined to very low figures. Best & Belcher has proved an excellent gambling stock, having sold as low as \$1.70 in January and touched \$9.50 in May. The following month it declined heavily selling at \$4.20, the top figure. Savage, that has been a regular bullion producer, has been the one stock of all others that appeared to be uninfluenced by the excitement caused by the north end advance. Opening the year at \$2.70 its advance was comparatively slight. In May, the "boom" month, it sold for \$4., and has gradually drifted back to ruling rates. Holders of Savage stock were particularly disgusted when, in addition to the mysterious heaviness displayed by the stock, they were called upon less than a month ago to pay an assessment of 50 cents per share, being the 77th levied. Chollar and Bullion being situated on the lode close to the Potosi shared its fortunes, although within the last month or two attention has again been attracted to Chollar. Hale & Norcross stock has acted in a manner somewhat akin to Savage but advanced during the last month or two, simultaneously with the initiation of legal proceedings against the directors of the company in the California courts.

The Gold Hill stocks have displayed no exceptional characteristics. The drainage operations have been carried on throughout the year, but this expense will have to be borne in patience until the lower levels are reached where, it is known, ore bodies exist in the Belcher, Crown Point and Overman mines. Meantime exploration work has been commenced in portions of the mines pumped out. Yellow Jacket has been a more or less steady producer throughout the year, but the stock has not shown any very wide fluctuations. Opening at \$2.05, it touched \$3.47 in May and has retrograded ever since. Alpha, Alta, and the less important stocks have relatively shown wider ranges in value.

The year of 1891 was noted especially for the little interest taken in outside stocks. The Bodie group has attracted little attention, albeit, Bodie Consolidated opened the year at 85c, and advanced to \$1.45 in April, since which time it has declined until it went begging at 50c. a month ago.

The Tuscaroras have sold at very low figures, but at present most of the mines are taking out ore—some of very high grade—and an advance is in order. Unfortunately it is generally believed that these mines are worked on the Comstock plan and consequently little confidence is felt, despite the favorable showing now being made.

The last year was ushered in by the assurance of a lively belief, on the part of mine managers, that 1891 would witness the uncovering of ore bodies in Challenge, Confidence, Crown Point, Hale & Norcross and the Savage mines. So far as the public know their belief was an erroneous one, for nothing of importance has been developed.

If the sentiment roused by the exposures made during the trial of the Hale & Norcross suit should result in united action on the part of Comstock shareholders, then in very truth the last days of 1891 will have witnessed the decadence of secret, autocratic and fraudulent rule on the lode, and 1892 will see the good work of purging out corruption continue.

ASSESSMENTS LEVIED BY MINING COMPANIES IN 1891.

NAME AND LOCATION OF COMPANY.	Total levied in 1891.	Total levied to date.	NAME AND LOCATION OF COMPANY.	Total levied in 1891.	Total levied to date.
Alliance, Utah.....	\$40,000	\$150,000	Kentuck Cons., Nev..	36,750	443,680
Alpha, Nev.....	15,000	146,250	Kingman Silver, Arz.	\$5,000	\$5,000
Alta, Nev.....	30,000	3,443,800	Lady Washington.....	21,400	128,400
Anchor, Utah.....	150,000	150,000	Martin White, Nev.....	50,000	1,275,000
Andes, Nev.....	30,000	1,030,000	Mexican, Nev.....	50,000	2,842,160
Belcher, Nev.....	104,000	3,082,000	Milwaukee, Mont.....	2,500	12,500
Best & B., Nev.....	100,800	2,380,075	Mono, Nev., Cal.....	12,500	772,500
Bodie Con., Cal.....	25,000	650,000	Navajo, Nev.....	15,251	515,521
Brunswick Con., Cal.	16,000	16,000	Nevada Queen, Nev..	15,000	215,000
Bullion, Nev.....	50,000	2,840,000	North Belle Isle, Nev.	50,000	445,000
Bulwer Con., Cal.....	15,000	145,000	N. Com'wealth, Nev..	25,000	85,000
Caledonia Silver, Nev.	150,000	3,185,000	N. G. & Curry, Nev..	30,000	270,000
Challenge Con., Nev..	50,000	180,000	Occidental Con., Nev.	25,000	220,000
Chollar, Nev.....	168,000	1,708,000	Ophir, Nev.....	50,000	4,260,640
Confidence Silver, Nev	18,720	366,320	Overman Silver.....	79,340	3,969,680
Con. Imperial, Nev.....	150,000	1,050,000	Peer, Ariz.....	15,000	180,000
Con. New York, Nev..	50,000	100,000	Peerless, Nev.....	10,000	415,000
Crocker, Nev.....	20,000	170,000	Potosi, Nev.....	112,000	1,685,000
Crown Pt., Nev.....	150,000	2,575,000	Ropes, G. & S., Mich.	20,000	167,200
Del Monte, Nev.....	29,053	94,053	Savage, Nev.....	112,000	6,716,000
E. B. & Belcher, Nev..	45,000	45,000	Scorpion, Nev.....	50,000	230,000
E. Sierra Nev., Nev..	16,000	16,000	Segr., B. & M., Nev..	50,000	6,376,900
Exchequer, Nev.....	25,000	890,000	Sierra Nev., Nev.....	30,000	1,968,600
Goodman, Nev.....	61,800	4,564,200	Silver Hill, Nev.....	30,000	190,000
Gould & Curry.....	168,000	5,366,800	Silver King, Ariz.....	60,000	8,000
Hale & Norcross, Nev.	5,000	27,000	Siskiyou Con. I., Cal.	10,000	20,000
Hartery Con. Cal.....	10,000	15,000	Union Con., Nev.....	80,000	2,390,000
Head Centre, Ariz.....	1,800	11,000	Utah, Nev.....	50,000	295,000
Himalaya, Utah.....	12,500	50,000	Weldon, Nev.....	10,000	50,000
Honorine, Utah.....	15,000	169,375	Wood River.....	3,000	3,000
Iron Hill, S. Dak.....	11,000	1,474,000	W. W. O. D., Cal.....	22,500	22,500
Julia Con., Nev.....	20,250	3,459,750	Yellow Jacket, Nev..	120,000	5,628,000

DIVIDENDS PAID BY AMERICAN MINES IN 1891, WITH TOTAL UP TO DATE

NAME OF COMPANY.	Location of mine.	Amount of dividends paid in 1891.	Total amount of dividends paid to date.	Present market value of company.
Adams.....	Colorado.....	75,000	627,000	285,000
Alaska Treadwell.....	Alaska.....	450,000	1,150,000	510,000
Alice.....	Montana.....	75,000	975,000	540,000
American Belle.....	Colorado.....	50,000	50,000	600,000
American Coal.....	Maryland.....	90,000	180,000	.....
Aspen.....	Colorado.....	100,000	660,000	800,000
Atlantic.....	Michigan.....	40,000	700,000	439,000
Aurora Iron.....	Michigan.....	200,000	355,000	.....
Bald Butte.....	Montana.....	30,000	32,500	375,000
Ballarast-Smuggler.....	Colorado.....	6,000	6,000	180,000
Bannister.....	Montana.....	72,000	96,000	.....
Bates-Hunter.....	Colorado.....	67,500	67,500	600,000
Best Friend.....	Colorado.....	70,900	70,900	325,000
Big Hole Placer.....	Montana.....	1,500	1,500	15,000
Bimetallic.....	Montana.....	240,000	1,200,000	6,500,000
Boston & Montana.....	Montana.....	530,000	2,075,000	1,812,500
Bull-Domingo.....	Colorado.....	29,000	49,000	.....
Calliope.....	Colorado.....	5,000	10,000	185,000
Calumet & Hecla.....	Michigan.....	2,000,000	56,850,000	25,350,000
Centennial-Eureka.....	Utah.....	330,000	502,500	1,350,000
Central.....	Michigan.....	20,000	1,970,000	360,000
Champion.....	California.....	45,900	69,700	.....
Clay County.....	Colorado.....	48,000	60,000	232,000
Coeur d'Alene.....	Idaho.....	80,000	310,000	525,000
Colorado Central.....	Colorado.....	13,750	13,750	313,700
Con. Cal. & Va.....	Nevada.....	216,000	3,682,800	864,000
Copper Bell.....	Montana.....	13,500	13,500	.....
Copitz.....	Nevada.....	60,000	60,000	.....
Cortez.....	Nevada.....	230,000	230,000	.....
Daly.....	Utah.....	450,000	2,212,500	3,087,500
Deadwood.....	South Dak.....	50,000	1,050,000	400,000
DeLamar.....	Idaho.....	150,000	170,000	2,400,000
Derbec Blue Gravel.....	California.....	20,000	260,000	.....
Dexter.....	Nevada.....	50,000	50,000	.....
Elkhorn.....	Montana.....	300,000	630,000	1,250,000
Enterprise.....	Colorado.....	2,400	250,000	.....
Eureka Consolidated.....	Nevada.....	50,000	4,932,000	75,000
Franklin.....	Michigan.....	80,000	1,010,000	590,000
Glengarry.....	Montana.....	10,000	10,000	675,000
Gold Rock.....	Colorado.....	28,750	28,750	335,000
Granite Mountain.....	Montana.....	1,400,000	11,600,000	7,000,000
Gt. Western Quicksilver.....	California.....	25,000	25,000	.....
Hecla Con.....	Montana.....	180,000	1,740,000	.....
Helena & Frisco.....	Montana.....	180,000	280,000	.....
Helena & Victor.....	Montana.....	20,000	70,000	250,000
Homestake.....	South Dak.....	150,000	4,793,750	1,437,500
Horn Silver.....	Idaho.....	200,000	4,350,000	1,580,000
Idaho.....	California.....	98,000	5,358,000	.....
Iron Mountain.....	Montana.....	25,000	95,000	435,000
Jackson.....	Nevada.....	5,000	60,000	.....
Kennedy.....	California.....	360,000	720,000	.....
Little Rule.....	Colorado.....	120,000	220,000	550,000
Maid of Erin.....	Colorado.....	419,175	1,771,125	4,191,750
Mammoth.....	Utah.....	320,000	1,040,000	1,200,000
Maryland Coal.....	Maryland.....	84,000	.....	.....
Maxfield.....	Utah.....	36,000	36,000	.....
Mayflower Gravel.....	California.....	75,000	75,000	.....
May-Mazepa.....	Colorado.....	110,000	170,000	1,150,000
Metropolitan.....	Michigan.....	350,000	1,637,500	.....
Minnesota Iron.....	Minnesota.....	840,000	1,260,000	3,080,000
Mollie Gibson.....	Colorado.....	1,070,000	1,000,000	7,500,000
Montana Ltd.....	Montana.....	82,500	2,685,287	1,359,600
Morning Star.....	Colorado.....	50,000	925,000	.....
Morning Star D.....	California.....	22,800	22,800	.....
Mt. Diablo.....	Nevada.....	30,000	210,000	90,000
Mt. McClellan.....	Colorado.....	12,540	12,540	.....
Napa.....	California.....	40,000	430,000	468,000
N. W. Guston.....	Colorado.....	440,000	1,086,250	1,925,000
Newton.....	California.....	10,000	10,000	.....
North Banner Cons.....	California.....	20,000	20,000	.....
North Commonwealth.....	Nevada.....	25,000	25,000	75,000
North Star.....	California.....	50,000	500,000	.....
Ontario.....	Utah.....	900,000	12,425,000	6,750,000
Oseola.....	Mich.....	150,000	1,597,500	1,375,000
Parrot.....	Montana.....	360,000	1,160,000	.....
Petro.....	Utah.....	17,500	17,500	.....
Plumas Eureka.....	California.....	70,200	2,618,246	369,000
Quicksilver.....	California.....	118,000	2,475,082	838,500
Quincy.....	Michigan.....	400,000	5,970,000	4,400,000
Red Cloud.....	Idaho.....	80,000	100,000	.....
Retriever.....	South Dak.....	12,500	12,500	25,000
Rialto.....	Colorado.....	32,250	32,250	530,000
Richmond Cons.....	Nevada.....	33,750	4,316,887	236,520
Rocky Fork Coal.....	Montana.....	100,000	100,000	.....
Running Lode.....	Colorado.....	25,000	30,000	240,000
Sheridan.....	Colorado.....	75,000	300,000	.....
Sierra Buttes.....	California.....	25,000	1,517,557	229,600
Silent Friend.....	Colorado.....	60,000	60,000	.....
Silver Glance.....	Colorado.....	4,500	4,500	.....
Silver Mfg. of L. V.....	New Mex.....	80,000	300,000	200,000
Standard.....	California.....	10,000	3,605,000	125,000
Tamarack.....	Michigan.....	800,000	2,470,000	7,750,000
Teal & Poe.....	New Mex.....	9,000	9,000	.....
Whale.....	Colorado.....	5,000	5,000	30,000
W. Y. O. D.....	California.....	6,000	6,000	.....
Yankee Girl.....	Colorado.....	200,000	1,065,000	625,000
Total, 96 companies.....		17,630,615	143,127,674	108,695,220
In 1890, 65 companies.....		13,743,478	116,950,302	89,200,500
In 1889, 61 companies.....		10,537,522	104,326,811	78,111,150
In 1888, 64 companies.....		13,061,105	104,483,719	90,045,531
In 1887, 63 companies.....		10,515,753	98,519,767	89,096,135
In 1886, 59 companies.....		10,282,693	81,751,981	85,707,771

IRRIGATION PROGRESS IN THE ARID WEST.

By J. W. Powell, Director of the United States Geological Survey.

During the past year greater progress has been made in the development of the irrigable lands and sources of water supply in this country than in any one previous year. The rapidity of this development is due to several causes, foremost among which has been the activity displayed by the Government as a result of Congressional enactment. The inauguration of the Irrigation Branch of the Geological Survey in 1889 and its work, the establishment of a bureau of artesian investigation as a branch of the Geological Survey, and the investigating tour made by a special committee of the United States Senate resulting in a voluminous report on the subject of irrigation, have been the most potent factors set at work by the Government. The passage of the Wright irrigation law by the State of California and the recent decisions in its favor made by the courts

of California, and the indorsements of the bonds of the irrigation districts by the bankers of that State, have had great influence in developing the resources of the Pacific slope. An exceptionally dry season in 1889 and consequent loss of property and crops were influential in attracting attention to the necessity of irrigation. The last acts in the series of progressive impulses given to the irrigation development were an Irrigation Congress held in Salt Lake City and attended by representatives of all of the arid states, and the collection of statistics relative to irrigation and issuance of bulletins thereon by the Census Bureau.

During the past year the financial returns derived from the various irrigation works already in operation were exceptionally good and the crops have been relatively as prolific and abundant in the arid region as elsewhere in the United States. Many new works and enterprises have been incorporated, and construction has been commenced or completed on many others. Millions of dollars of capital have been raised and invested in work of this character, and the East as well as the West is arriving at an appreciation of the benefits to be derived from the development of irrigation.

Of 2,000 of the more important irrigation canals in the West, nearly half have a bed width of over 5 ft., the greatest being 80 ft. in width. The aggregate length of these is 9,000 miles, while they have nearly double that length of laterals and distributaries. The total cost of these works was over \$27,000,000, and they covered a total area of 2,000,000 acres of irrigable land, all of which was under cultivation; while an even greater area is commanded by and can be irrigated from them whenever the demand arises. Of the 2,000 canals, about 450 are in Colorado, 270 in Utah, 230 in Montana, 200 in California, and smaller numbers in other states. In addition to these canals there are a large number of reservoir and irrigation projects now in course of construction or projected.

The following table contains some further statistics relative to the irrigation resources of the West; it shows the cost and value of water per acre, the annual average cost of water and the cost of bringing land under cultivation, exclusive of the water cost. It is taken from the Census bulletins and is complete for but six states.

STATES.	Average first cost per acre.	Average value per acre.	Average annual cost per acre.	Average cost of cultivation per acre.
Arizona.....	\$7.07	\$12.58	\$1.55	\$8.60
Idaho.....	4.74	13.18	.89	9.31
Montana.....	4.63	15.04	.95	8.29
New Mexico.....	5.58	18.30	1.54	11.71
Utah.....	10.15	26.84	.91	14.35
Wyoming.....	3.62	8.69	.14	8.23

A study of this table shows that of the states enumerated, those in which the average first cost of water per acre is least are Montana and Wyoming. The cause is evident. In these States the natural supply of water from precipitation is relatively large. As a result there are many small streams, the waters of which can be cheaply and easily diverted to the irrigable lands. As the demand for water for purposes of irrigation is as yet relatively small, only that which can be most cheaply obtained has been utilized. In Utah the cost is highest from a reverse reason to that above stated. Likewise in Utah the average value of water per acre is relatively high, both because it is expensive to obtain and because the market value of the products raised on the soil is relatively high. In California the cost of cultivation per acre will prove to be the highest of all, the result of the value of both the land and water and the necessity of making the best use of these.

In the past year a number of new irrigation districts have been organized in California under the provisions of the Wright law, prominent among which are the Alessandro, Parris, Modesto, Otay and others. Since the passage of the Wright law and up to the present date over 30 irrigation districts have been organized in California and bonds to a large amount issued. In some cases these securities have been used in payment of water rights of irrigation works already constructed, but in a majority of instances the proceeds of the bonds are to be directly devoted to the construction of the necessary works. The following table contains a list of these irrigation districts and their location:

NAME OF DISTRICT.	County.	No. of Acres.	Bonds voted.	Bonds sold.	B'ds per acre.
Alessandro.....	San Bernardino.....	25,000	\$765,000	\$765,000	\$30.00
Cirrus Belt.....	".....	11,700	800,000	800,000	68.37
East Riverside.....	".....	3,630	250,000	190,000	83.33
Grapeland.....	".....	10,787	200,000	None.	18.54
Rialto.....	".....	7,200	500,000	500,000	69.44
Elsiuere.....	San Diego.....	11,300	None.	None.	.....
Escondido.....	".....	12,814	450,000	None.	35.12
Fallbrook.....	".....	12,903	None.	None.	.....
Murrieta.....	".....	15,600	None.	None.	.....
Parris.....	".....	22,800	442,000	252,000	19.18
Spring Valley.....	".....	22,000	None.	None.	.....
Big Rock Creek.....	Los Angeles.....	30,000	400,000	150,000	13.33
Pomona Orange Bell	".....	4,500	200,000	None.	44.44
Via land.....	".....	4,500	50,000	50,000	11.11
Santa Gertrudes.....	".....	2,630	None.	None.	.....
Anaheim.....	Orange.....	32,530	600,000	None.	18.46
Orland Southside.....	Colusa.....	25,000	None.	None.	.....
Central.....	".....	156,550	750,000	286,000	4.78
Kraft.....	".....	13,500	80,000	None.	5.93
Colusa.....	".....	100,000	600,000	None.	6.00
Tulare.....	Tulare.....	26,719	50,000	150,000	13.61
Poso.....	Kern.....	49,000	500,000	250,000	12.50
Kern and Tulare.....	".....	84,335	700,000	357,000	8.60
Madera.....	Fresno.....	305,000	850,000	None.	2.78
Ara.....	Fresno and Tulare.....	13,927	675,000	419,000	5.19
Sunset.....	".....	333,400	2,000,000	None.	5.50
Seima.....	".....	171,000	None.	None.	.....
Modesto.....	St. nislaus.....	81,500	800,000	142,000	9.81
Turlock.....	Stanislaus and Merced.....	176,210	600,000	422,500	3.40
Brown's Valley.....	Yuba.....	43,000	110,000	100,000	3.56
		2,055,042	\$12,822,000	\$4,733,500	

From the above table it will be seen that under the district law alone a total of 2,055,042 acres have been bonded as irrigable and a water sup-

ply either has been or is in course of being provided for them. Bonds to the extent of \$12,822,000 have been voted, of which \$4,733,500 have already been sold, the proceeds of which have been directly expended in engineering work or right of way charges. Scarcely anything additional is needed to give an adequate idea of the vast proportions to which irrigation development has attained in this country. The figures, both in mileage of canals, acres of land controlled, and many investigated are so stupendous as to be scarcely comprehensible.

In the following table are given the dimensions, cross-section, slope, capacity and other points of engineering interest on a few of the larger and more recently constructed irrigation works.

CANAL.	Locality.	Source.	Area, com- manded, acres.	Capacity, second feet.	Length, in miles.	Grade, feet per mile.	Bed width at head in feet.	Depth, in feet.
Wyoming Devel- opment Co.....	Wyo....	Big Laramie River.	60,000	650	54	2	25	5
Bear River Canal.....	Utah....	Bear River.....	200,000	1,000	150	1	50	7
Boise Canal.....	Idaho..	Boise River.....	350,000	2,585	70	2	40	10
Turlock Canal.....	Cal....	Tuolumne River..	176,000	1,560	93	1	70	7 1/2
Folsom Canal.....	Cal....	American River..	125,000	1,210	.....	.....	34	8
Cent. Irrig. Dist.	Cal....	Sacramento River.	156,550	730	69	1 1/2	36	6
Kraft Irrig. Dist..	Cal....	Stony Creek.....	13,800	130	24	1	16	3
Modesto Canal.....	Cal....	Tuolumne River..	80,000	610	25 1/2	.....	28	7
Pecos Canal.....	N. M....	Pecos River.....	200,000	1,100	75	1 1/2	45	6
Colo. Land & Water Co.....	Colo....	Arkansas River..	50,000	900	75	1 1/2	35	8

From a perusal of the above table it will be seen that there are some very large canals already built in the West. There are many others in addition to those here noted, some of which have been constructed for a number of years. Those given above include the principal ones which have recently been completed. In addition there are many others just completed or in course of construction, but a special mention of which is considered unnecessary, the object of the table being merely to give a general idea of the dimensions of some important canals. On the lines of these are extensive engineering works, great diversion weirs, massive regulating gates and escape ways, long and high flumes and trestles and many thousand feet of tunnels, beside innumerable falls, distributary heads and minor works. The mileage of canals above indicated includes only the main line. There are twice as many miles of important laterals and distributaries.

The following table shows the cost of constructing reservoirs in the West:

	Locality.	Material of dam.	Cost per acre foot stored.
Sweetwater Reservoir.....	California.	Masonry.	\$40.90
Bear Valley	".....	".....	5.30
Merced	".....	Earth.	26.60
Cuyamaca	".....	".....	9.00
Tuolumne Meadows Reservoir.....	".....	Loose rock.	3.66
Little Yosemite Reser- voir.....	".....	".....	13.65
Lake Eleanor Reser- voir.....	".....	".....	2.10
Upper Sun River Reser- voir.....	Montana.	Masonry.	5.66
Lower Sun River Reser- voir	".....	".....	10.06
Willow Creek Reser- voir.....	".....	Earth.	4.55
El Paso Reservoir.....	Texas.	Masonry.	5.00
Castlewood	Colorado.	".....	38.00
Twin Lakes	(estimated).....	Earth.	2.00
Swan Valley	".....	Loose rock.	.33
Jackson Lake	".....	".....	.20
Webber Lake	Nevada.	".....	3.90
Middle Carson	".....	".....	4.88

From this table it will be seen that in a number of cases the cost estimated is for works not yet constructed. The range is great, depending upon the material, convenience of transportation, and especially upon the character of the dam site and its relation to the volume of water stored. The capacities of these reservoirs differ enormously, ranging from a few hundred acre-feet, in the case of the Cuyamaca reservoir, to 1,500,000 acre-feet in the case of the Swan Valley reservoir.

The necessity for constructing storage reservoirs for the conservancy of the flood waters of streams is becoming daily better appreciated. There are many millions of acres of good irrigable land, more than can be irrigated from water flowing in the streams during irrigating season. This land must forever be idle and comparatively valueless unless a water supply can be provided for it from some source. Enormous volumes of water, far greater in amount than that which flows during the irrigating season, run annually to waste in the remainder of the year, and especially when the streams are in flood. Much of this can be saved in storage reservoirs and utilized for irrigation in the proper season. It is for this purpose that these storage reservoirs have been constructed, while many others have been projected or are in course of construction. These reservoirs differ as widely in the character of their dams and other works as they do in their capacity.

As yet but a few of these have been built or are in active operation. They may be divided into two classes—those situated in the higher hills and mountains and constructed on some running stream by damming this, and those which are built on the plains or bench lands at the foot of the hills. These latter are usually constructed in natural depressions in the surface of the land and have little or no catchment basin of their own. They are filled by canals diverted from neighboring streams. Among this class are the Modesto reservoir in California and many large and small reservoirs built on the plains between the Colorado and Platte rivers, east of Denver and Pueblo. In every case of this kind the dam to be constructed is of trifling dimensions, usually of earth, while frequently the outlet of the reservoir has to be deepened by means of a cut in order to drain the lake basin. The following table gives the details of a number of

more important reservoirs which have been built in the West in recent years:

Table with 6 columns: Name of reservoir, Locality, Capacity Acre-ft., Character of dam, Maximum height of dam. ft., Length of dam. F.

As will be seen from the table, there is somewhat of a diversity in the material used in constructing the dams for these works. There is a still greater diversity in the character of construction and the general design.

The Irrigation Survey has projected and made detailed surveys and estimates for the construction of a large number of great reservoirs to be built in the arid regions.

Table with 6 columns: Name of Reservoir, Locality, Capacity, Acre-Feet., Character of dam, Maximum height of dam, Feet., Length of dam, Feet.

As will be observed, several of these reservoirs are of an enormous capacity, especially the Twin Lakes and El Paso reservoirs, two of the most feasible and most likely of construction.

In addition to these reservoirs for which detailed surveys and estimates have been made by the engineers of the Geological Survey, there were several others surveyed at the same time, making a total of 30 reservoirs, the sites of which have been segregated in accordance with the recent laws of Congress and have been reserved from entry excepting for purposes of reservoir construction.

these, but the sites were carefully mapped and their areas platted, and the lands contained therein reserved from entry for other purposes than reservoir construction.

The topographers of the Irrigation Survey have mapped during the last year 25,000 square miles in the region west of the 100th meridian at a scale of one mile to the inch and in contours the vertical interval of which varies between 25 ft. and 100 ft.

Great advances have been made recently in our knowledge of the hydrography of the arid region. Experiments have been conducted to ascertain the amount of evaporation in various portions of the West.

Valuable additions have been made to the literature of irrigation during the past year; in fact, a literature may be said to have been started, as little relative to the irrigation of the United States had previously been published.

THE WEEKLY METAL MARKET.

This issue being a general review covering the entire year, our regular weekly departments—Personals, Obituary Notes, Industrial Notes, General Mining News, Foreign Mining News, and Market Reports—have been omitted.

Our comprehensive list of prices current, which is regularly included in our export numbers, published on the first Saturday of each month, has also been omitted in this issue.

CURRENT PRICES.

These quotations are for wholesale lots in New York unless otherwise specified.

Table listing prices for various materials including Asphaltum, Litharge, Magnesite, Marble Dust, Metallic Paint, Mineral Wool, Mica, Naphtha, Nitrate, Ochre, and Salt.

Table listing prices for various minerals and chemicals including Oils, Mineral, Phosphorus, Potassium, Pumice Stone, Pyrites, Quartz, Rotten Stone, Sal Ammoniac, and Salt.

Table listing prices for various metals and alloys including Salt-peter, Soapstone, Sodium, Stannate, Tungstate, Hypo-sulphite, Strontium, Sulphur, Sylvinit, Tale, Terra Alba, Tin, Titanium, Zinc, and various metal salts.

Table listing prices for various metals including Calcium, Cerium, Chromium, Cobalt, Didymium, Erbium, Gallium, Gadolinium, Indium, Iridium, Lanthanum, Lithium, Magnesium, Manganese, Molybdenum, Niobium, Osmium, Palladium, Platinum, Potassium, Rhodium, Rubidium, Selenium, Sodium, Strontium, Tantalum, Tellurium, Thallium, Titanium, Thorium, Tungsten, Uranium, Vanadium, Yttrium, and Zirconium.

THE RARER METALS.

Table listing prices for rarer metals including Arsenic, Barium, Bismuth, and Cadmium.